

STUDENT'S ARITHMETIC,

A COLLECTION OF

CONCISE RULES AND ABRIDGED METHODS OF CALCULATION,

ADAPTED TO THE USE OF SCHOOLS,

FARMERS, MERCHANTS, AND BUSINESS MEN GENERALLY,

WITH AN APPENDIX

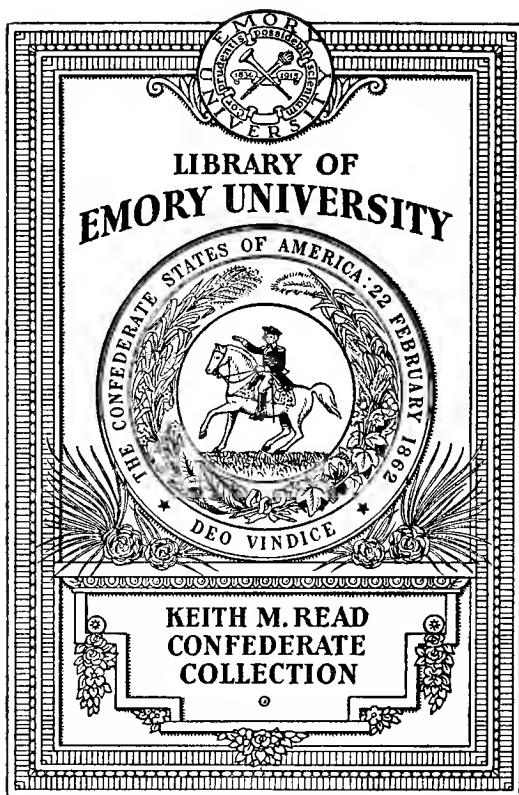
CONTAINING LEGAL FORMS, BILLS OF SALE, DEEDS, WILLS &c.

BY M. P. CALDWELL & W. W. EVERETT.

ATHENS, GEORGIA.

J. H. CHRISTY'S FRANKLIN JOB OFFICE PRINT.

1861.



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STUDENT'S ARITHMETIC;

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M. P. CALDWELL AND W. W. EVERETT,
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PREFACE.

There has long been a want in our schools and country of a work on Arithmetic, embracing all the “*practical business rules*,” and at the same time excluding all *useless* and *worthless* matter from its pages,—incidental to most of our Text-books.

We have ventured, therefore, to put forth this work, on the science of numbers, believing that it will supply this want, at least in part. Our rules are plain, simple and comprehensive,—the examples are of a practical character—the order of arrangement perfectly easy and natural, and the most important methods of abridging operations, applicable to business transactions, so introduced as to interest the student, and inspire a love for this useful science. And while we have excluded from our book several “old rules and distinctions,” which modern improvements have superseded, we, nevertheless, have every rule that can be of use to the student or business men generally

The principles of *cancellation* are fully and carefully explained; and the student is taught to apply it in all cases in which it is applicable.

We have endeavored to give *our own rules* in this work, in all cases,—but, says a distinguished author, “to be original in a work on Arithmetic is a well known impossibility.”

In the preparation of this work, we have consulted the works of several distinguished authors, among whom we would mention LOONEY, GREENLEAF and THOMPSON, as the most prominent; and we acknowledge particular indebtedness to their works for valuable assistance, and should any one wish a good High School Arithmetic, we would recommend any of the above mentioned as being worthy Text-books, and good authority.

We ask a calm and unprejudiced examination of our work, and we hope no one will rashly pre-judge, for *sensible persons* will examine well before they judge, and *prudent persons* will understand before they will either approve or condemn.

We respectfully ask teachers and friends to forward their criticisms and suggestions to us, and should the reception of this edition call for a second, we can only promise, by giving

due consideration to all suggestions forwarded to us, that we will strive to make the second edition of our book quite an improvement on the first.

To the *teachers* and *youth* of the South, we commend our work, hoping that among them it will find many warm friends, and that in it they will find that tuition which will be useful to them through life.

THE AUTHORS.

ATHENS, GA., Jan. 1861.

SUGGESTIONS ON TEACHING ARITHMETIC.

QUALIFICATIONS—The chief qualifications requisite in teaching *Arithmetic* as well as other branches, are the following :

A thorough knowledge of the subject.

A love for the employment.

An aptitude to teach. *These are indispensable to success.*

CLASSIFICATION—*Arithmetic*, as well as other studies, should be taught in classes.

This method saves much time, and thereby enables the teacher to devote more time to *oral illustrations*.

The action of mind upon mind, is a *potential stimulant* to exertion, and can not fail to create a *zeal* for the study. The mode of analyzing and reasoning of one scholar, often suggests new ideas to others in the class.

In *classification*, those should be put together who possess as nearly equal capacities as possible. If any of the class learn faster than the others they should be allowed to take an extra study, or be furnished with additional examples to solve, so that the whole class may advance together.

THE BLACKBOARD should be one of the indispensables of the school-room. Not a recitation should pass without its use. When a principle is to be

demonstrated or an operation explained, if done upon the *blackboard*, all can see and understand at once.

RECITATION—The *first object* in conducting a recitation, should be *to secure the attention of the class*. This is done chiefly by *blending life and variety* with the exercise. Students generally loathe dullness, while animation and variety are their delight. Every example should be carefully *analyzed*, the “*why and wherefore*” of every step in the solution should be required, till the learner becomes perfectly familiar with the process of reasoning.

THOROUGHNESS—This should be the motto of every teacher ; without it, the great objects of study are radically defeated.

In securing this object, much advantage is derived from frequent reviews.

INTRODUCTORY EXPLANATION.

It will be observed that we draw a perpendicular line in most of our solutions; this is done to separate the divisors from the dividends, as all numbers placed on the left, in all operations, are considered *divisors* and all on the right are *dividends*.

In all operations we cancel if possible as explained under the head "Multiplication of Fractions," but when we cannot we have to divide the products of the numbers on the right by the product of those on the left.

We generally factor those numbers belonging on the left because it will always shorten the process and dispense with long division.

Instead of multiplying at the commencement of a solution we always commence dividing, if possible, across the perpendicular line, which greatly shortens the work, saves a great deal of time, *which*, Dr. Franklin said, *is money*, and almost precludes the possibility of mistakes. Division and Multiplication are the principal rules used in all solutions in our work.

By our Method of working fractions we use them as *whole numbers* in the *solutions*, but use them as fractions in the questions and answers.

It must be remembered in all operations and solutions, in all rules, never to work with mixed numbers, but reduce them to improper fractions as directed under the head of "Multiplication of Fractions." Also never to leave a figure unmarked, when it has been used, but mark it thus, \bar{A} , \bar{Z} , \bar{S} , \bar{A} , \bar{P} , \bar{G} , \bar{H} , \bar{S} , \bar{P} , \bar{O} . Also, remember that a cipher on either side of the line is a multiplier of ten except when standing between other figures. By observing these directions the student will advance in our work more rapidly, more easily, and more profitably, than in any of the works now in use. In short, it will be found on examination *to teach an easy method of calculation and afford interesting and necessary knowledge to all men of business.*

ARITHMETICAL SIGNS.

$=$ Sign of equality; $5=5$, read five equals five.

$+$ Plus, the sign of addition; $4+8=12$, read four plus eight equals twelve.

$-$ Minus, the sign of subtraction; $9-3=6$, read nine minus three equals six.

\times Sign of multiplication, $4\times 2=8$, read four multiplied by two equals eight.

\div Sign of division; $12\div 3=4$, read twelve divided by three equals four.

$\sqrt{}$ Radical sign, or sign of square root, when placed over a number signifies that the square root is to be extracted; $\sqrt{64}=8$, read the square root of sixty-four equals eight.

$\sqrt[3]{}$ Sign of cube root shows that the cube root is to be extracted; $\sqrt[3]{27}=3$, read the cube root of twenty-seven equals three.

ARITHMETIC.

ARITHMETIC is the science of numbers and the art of computing by them.

A *number* is a unit or a collection of units.

A *unit* is a single thing, or one.

Quantity is anything that can be increased, diminished, or measured.

The *fundamental* rules of arithmetic are *Addition*, *Subtraction*, *Multiplication* and *Division*.

NUMERATION.

NUMERATION is the process of reading numbers when expressed by figures.

There are ten figures, used to express numbers in arithmetic, viz: 1, 2, 3, 4, 5, 6, 7, 8, 9, 0. Each figure has two values—*simple* and *local*. The *simple value* is that expressed by the figure when standing alone. The *local value* is that expressed when connected with other figures. This may be illustrated by a table,—thus :

9	8	7	6	5	4	3	2	1	4	5	8	6
Units	Tens	Hundreds	Thousands	Tens of Thousands	Hundreds of Thousands	Millions	Tens of Millions	Hundreds of Millions	Billions	Tens of Billions	Hundreds of Billions	Trillions &c.

The *cipher* denotes the absence of something, and when placed to the right of a figure, it increases the value of that figure *ten times*, or multiplies it by *ten*.

ADDITION.

ADDITION is the process of finding the sum of two or more numbers.

RULE.

Set down the numbers, units under units, tens under tens, &c., and begin at the right hand column to add—if the sum does not exceed 9, set it down under it—should it exceed 9, set down the right hand figure and carry the left to the next column to the left. Proceed in this manner with each column, and set down the whole sum of the left hand column.

EXAMPLES.

1. If a man has 465 bushels of corn in one crib, 234 in another. 897 in another and 514 in another, how many has he in all? Ans. 2110.

OPERATION. 465 We add the right hand column
234 and find it makes 20, we set down
897 the 0 and carry the 2 to the next
514 column, and so on.

2110. Ans.

2. I buy 400 acres of land at one time, 392 at another, 875 at another, how many do I buy in all?
 Ans. 1667 acres.

3. Add 60, 86, 135, 496, 916, 15 and 8 together.
 Ans. 1716.

4. Add 22, 44, 11, 888, 555 and 33 together.
 Ans. 1553.

5. If you buy 8 yards cloth from one merchant, 20 yards from another, 16 yards from another, and 4 yards from another, how many did you buy?
 Ans. 48 yards.

6. Add 18782, 21, 328, 489, 5876, and 1008.
 Ans. 26507

7. What is the sum of $22+38+46+412+324+1008$?
 Ans. 1859.

8. What is the sum of $4000+385+15+63+713+6$?
 Ans. 5187

9. Add $22456+892+513+120+987+30+5$.
 Ans. 25303.

10. Add 50 dozen eggs, 15 dozen, 65 dozen, 24 dozen and 36 dozen.
 Ans. 190 dozen.

SUBTRACTION.

SUBTRACTION is the process of finding the difference between any two numbers.

The answer or number obtained is the *difference* or *remainder*.

The number to be subtracted is the *Subtrahend*,

and the number from which it is to be subtracted is the *Minued*.

GENERAL RULE FOR SUBTRACTION.

Write the less number under the greater, (only for convenience) so that units may stand under units, tens under tens, &c.

Begin at the units' place and subtract the lower figure from the upper, or that which stands immediately above it, and place the difference under the figure subtracted.

When the figure in the less number is greater than the one immediately above it, add 10 to the upper figure, then subtract as before, and add one to the next left hand lower figure.

- | | |
|--|------------------------|
| 1. From 876 | 3. From 896076 |
| Take 553 | Take 578589 |
| — | Ans. 317487 |
| 325 Ans. | 4. From 900020 |
| 2. From 8769 | Take 896534 |
| Take 6757 | Ans. 3486 |
| Ans. 2012 | 5. From 8796 take 2675 |
| | Ans. 6121 |
| 6. " 1000 " 999 | " 1 |
| 7 " 275846 " 37849 | " 237997 |
| 8. If I have 90 bus. corn and sell 65 bus., how many will I have left ? | Ans. 25 bus. |
| 9. In a certain Academy there are 357 scholars, 168 are young ladies, how many young gentlemen are there ? | Ans. 289 |
| 10. John borrowed of James \$486.50, and paid him \$376.25, how much does he still owe ? | Ans. \$110.25 |

MULTIPLICATION.

MULTIPLICATION is the process of taking one number as many times as there are units in another number. The number to be multiplied is the *multiplicand*. The number by which we multiply is the *multiplier*. The answer or number produced by multiplying is the *product*. Thus, 6 times 12 is 72. 6 is the multiplier and 12 is the multiplicand, 72 is the product.

MULTIPLICATION TABLE.

2 times	3 times	4 times	5 times
1 is	2 1 is	3 1 is	4 1 is 5
2 is	4 2 is	6 2 is	8 2 is 10
3 is	6 3 is	9 3 is	12 3 is 15
4 is	8 4 is	12 4 is	16 4 is 20
5 is	10 5 is	15 5 is	20 5 is 25
6 is	12 6 is	18 6 is	24 6 is 30
7 is	14 7 is	21 7 is	28 7 is 35
8 is	16 8 is	24 8 is	32 8 is 40
9 is	18 9 is	27 9 is	36 9 is 45
10 is	20 10 is	30 10 is	40 10 is 50
11 is	22 11 is	33 11 is	44 11 is 55
12 is	24 12 is	36 12 is	48 12 is 60
6 times	7 times	8 times	9 times
1 is	6 1 is	7 1 is	8 1 is 9
2 is	12 2 is	14 2 is	16 2 is 18
3 is	18 3 is	21 3 is	24 3 is 27
4 is	24 4 is	28 4 is	32 4 is 36
5 is	30 5 is	35 5 is	40 5 is 45
6 is	36 6 is	42 6 is	48 6 is 54
7 is	42 7 is	49 7 is	56 7 is 63
8 is	48 8 is	56 8 is	64 8 is 72
9 is	54 9 is	63 9 is	72 9 is 81
10 is	60 10 is	70 10 is	80 10 is 90
11 is	66 11 is	77 11 is	88 11 is 99
12 is	72 12 is	84 12 is	96 12 is 108

10 times		11 times		12 times		13 times	
1 is	10	1 is	11	1 is	12	1 is	13
2 is	20	2 is	22	2 is	24	2 is	26
3 is	30	3 is	33	3 is	36	3 is	39
4 is	40	4 is	44	4 is	48	4 is	52
5 is	50	5 is	55	5 is	60	5 is	65
6 is	60	6 is	66	6 is	72	6 is	78
7 is	70	7 is	77	7 is	84	7 is	91
8 is	80	8 is	88	8 is	96	8 is	104
9 is	90	9 is	99	9 is	108	9 is	117
10 is	100	10 is	110	10 is	120	10 is	130
11 is	110	11 is	121	11 is	132	11 is	143
12 is	120	12 is	132	12 is	144	12 is	156

Observation. The pupil will be greatly assisted in the use of this table by observing the following particular :

1st. The several results of multiplying by 1 with any number of ciphers to the right are formed simply by adding the ciphers to the number to be multiplied.

RULE.

Write the multiplier under the multiplicand, units under units, tens under tens, &c. When the multiplier contains but one figure, begin with the units, and multiply each figure of the multiplicand by the multiplier, setting down the result and carrying as in addition. If the multiplier contains more than one figure, multiply each figure of the multiplicand by each figure of the multiplier separately and write

the figure of each partial product under the figure by which you are multiplying. Then add the products together and the sum will be the whole product.

EXAMPLES.

- | | |
|---|--------------------------|
| 1. Multiply 26 by 2 | Ans. 52 |
| 2. Multiply 126 by 3 | Ans. 378 |
| 3. Multiply 326 by 4 | Ans. 1304 |
| 4. Multiply 472 by 5 | Ans. 2350 |
| 5. Multiply 581 by 6 | Ans. 3486 |
| 6. Multiply 623 by 7 | Ans. 4361 |
| 7. Multiply 8243 by 8 | Ans. 65944 |
| 8. Multiply 1001 by 9 | Ans. 9009 |
| 9. Multiply 2010 by 10 | Ans. 20100 |
| 10. Multiply 7201 by 11 | Ans. 79211 |
| 11. Multiply 9202 by 12 | Ans. 110424 |
| 12. | $4623 + 2185 = 10101255$ |
| 13. What will 7 horses cost at \$120 each ? | |

OPERATION.

$$\begin{array}{r} \$120 \\ 7 \\ \hline \end{array}$$

Ans. \$840

14. If a man travels 110 miles in 1 day, how far will he travel in 8 days?

OPERATION.

$$\begin{array}{r} 110 \text{ miles} \\ 8 \text{ days} \\ \hline \end{array}$$

Ans. 880 miles.

15. What will 3 town lots cost, at 562 dollars each?
- | | | |
|------------|---|---|
| OPERATION. | } | <i>Suggestion.</i> If 1 lot cost 562 dollars, 3 lots will cost 3 times as much. |
| $\$562$ | | |
| 3 | | |

—
Ans. 1686 dollars.

16. What will 24 yards cloth cost at 12 cents per yard?
- Ans. 2.88

17. What will 25 bushels of corn cost at 56 cents per bushel?
- Ans. 14.00

18. How many bushels of corn can grow on 83 acres of land at the average rate of 37 bus., per acre?
- Ans. 3071 bus.

19. What will 63 pounds of Mountain Dew Tobacco cost at 75 cts. per lb?
- Ans. \$47.21

20. Bought of Scranton & Zimmerman 56 sacks of salt at \$1.25 per sack, what did they cost?
- Ans. \$70.00

21. 84209×72032 Ans. 6065742688

22. 940325×52363 Ans. 49238237975

NOTE. When there are ciphers on the right of the multiplicand or multiplier or both, multiply the whole number together, then annex the ciphers to the product.

23. Multiply 1920×2000 Ans 3840000

24. Multiply 370.000×32 Ans. 11840000

25. What will 42000 lbs. cotton cost at 10 cents per lb?
- Ans. \$4200.00

26. What will 3600 lbs. of bacon cost at 20 cts. per lb?
- Ans. 720.00

27 What will 1100 yards of bagging cost at 14 cents per yard ? Ans. \$154

DIVISION .

DIVISION is the process of finding how many times one number is contained in another.

The number to be *divided* is the *dividend*.

The number by which we divide is the *divisor*.

The number of times the divisor is contained in the dividend is the *quotient*.

The number which is left after division is the *remainder*, which must always be less than the divisor.

NOTE. When the dividend denotes things of one kind it is simple division.

To divide simple numbers :

RULE.

Place the divisor to the left of the dividend, then find how many times the divisor is contained in the fewest figures of the dividend that will contain it for the first quotient figure. Multiply the divisor by this quotient figure, and subtract the product from the figures of the dividend used. With the remainder unite the next figure of the dividend ; and find how many times the divisor is contained in the number thus formed for a new quotient figure, which

write at the right of the former quotient figure, and so on until all the figures of the dividend are used.

EXAMPLES.

1. Divide 72876 by 7

OPERATION.

$$7 \overline{)72876}$$

10410+6 Quotient.

2. Divide 8756 by 4 Ans. 2189

3. Divide 1728 by 12 Ans. 144

4. Divide 2160 by 18 Ans. 120

5. Divide 67864 by 24.

1st OPERATION.

Factors of $\left\{ \begin{array}{l} 6 \\ 4 \end{array} \right\}$ 67864

divisor 24 $\left\{ \begin{array}{l} 6 \\ 4 \end{array} \right\}$

$$\begin{array}{r} 67864 \\ \hline 11310+4 \end{array}$$

$$\begin{array}{r} 2827+2 \times 6 = 12+4 = 16 \text{ rem.} \end{array}$$

2d OPERATION.

Divisor Dividend Quotient.

$$24 \overline{)67864} \quad (2827$$

$$\begin{array}{r} 48 \\ \hline \end{array}$$

$$\begin{array}{r} 198 \\ \hline \end{array}$$

$$\begin{array}{r} 192 \\ \hline \end{array}$$

$$\begin{array}{r} 66 \\ \hline \end{array}$$

$$\begin{array}{r} 48 \\ \hline \end{array}$$

$$\begin{array}{r} 184 \\ \hline \end{array}$$

$$\begin{array}{r} 168 \\ \hline \end{array}$$

16 Remainder.

NOTE. Multiply the *last remainder* by the *first divisor* and add in the *first remainder* for the true remainder.

6. If a man travel 16 miles in an hour, how long will it take him to travel 384 miles?

Ans. 24 hours.

7. An army plundered a city and took 44,000 dollars, how many dollars is that apiece if there are in the army 2000 men?

Ans. \$22

8. C. gave 2500 dollars for 100 acres of land, what is that per acre?

Ans. \$25

9. The distance around the earth is computed to be 35,000 miles, how long will it take a man to walk round it, if he travels at the rate of 35 miles per day?

Ans. $714\frac{2}{3}$ days?

10. I set out in my orchard 8910 apple trees, and 33 rows they made. I wish to know how many there are in each row.

Ans. 270

11. Bought of Wm. N. White, Athens, 96 books for \$320.50, what is the average price of each book?

Ans. $\$3.33\frac{41}{8}$

12. Crane & Co., bought 4650 barrels of corn, for which they paid \$37,200, what is one barrel worth?

Ans. \$8

13. George F. Platt bought in Baltimore, 950 pair of shoes for \$612.50, what was the cost of a single pair?

Ans. $64\frac{2}{17}$ cts.

APPLICATION IN THE FUNDAMENTAL RULES.

The four fundamental Rules are *Addition*, *Subtraction*, *Multiplication* and *Division*.

EXAMPLES.

1. If from the sum of 1563 and 2570, you take the sum of 3278, then multiply the remainder by 387, and divide the product by 273, what will be the quotient ? Ans. 1212

2. George F Platt bought 68 bales of cloth, each bale contained 34 pieces and each piece 29 yards, how many yards did he buy ?

Ans. 67048

3. What number besides 137 will exactly divide 11371 ? Ans. 83

4. What cost a farm containing 365 acres \$97 per acre ? Ans. \$35405

5. If 640 acres make a square mile, how many acres in a town, which contains 89 square miles ? Ans. 56960

6. An acre contains 160 square rods, how many acres in a farm containing 123040 square rods ?

Ans. 769 acres.

7 Which is the greater value, 386 acres of land at \$76 per acre, or 968 hogsheads of molasses at \$25 per hogshead ? Ans. the land by \$5136

8. If 144 square inches make 1 sq. foot, how many square feet in 20736 inches ? Ans. 144 feet

9. How many times can 437 be subtracted from 18791 ? Ans. 43 times.

10. If the quotient is 275, the divisor 383, and the remainder 49, what is the dividend ?

Ans. 105374

TABLES.

TABLES OF MONEY, WEIGHTS AND MEASURES.

FEDERAL MONEY.

10 Mills make 1 Cent, marked cts.

100 Cents “ 1 Dollar, marked \$.

AVOIRDUPOIS WEIGHT.

16 Drams make 1 Ounce, marked oz.

16 Ounces “ 1 Pound, marked lb.

25 Pounds “ 1 Quarter marked qr.

4 Quarters “ 1 Hundred weight, marked cwt.

20 Hundred weight make 1 Ton, marked ton.

LONG MEASURE.

12 Inches make 1 Foot, marked ft.

3 Feet make 1 Yard, marked yd.

$5\frac{1}{2}$ Yards make 1 Rod or Pole, marked rd. and po.

40 Rods make 1 Furlong, marked fur.

8 Furlongs “ 1 Mile, marked m.

$69\frac{1}{2}$ Miles make 1 Degree marked deg.

360 Degrees “ 1 Circumference of the Earth.

CLOTH MEASURE.

$2\frac{1}{4}$ Inches make 1 Nail, marked na.

4 Nails make 1 Quarter marked qr.

4 Quarters “ 1 Yard marked yd.

DRY MEASURE.

- 2 Pints make 1 Quart, marked qt.
 8 Quarts make 1 Peck, marked pk.
 4 Pecks make 1 Bushel, marked bu.
 5 Bushels make 1 Barrel, marked bbl.

SQUARE MEASURE.

- 144 Square inches make 1 Square foot, marked sq. ft.
 9 Square feet make 1 Square yard, " sq. yd.
 30½ Square yards make 1 " rod or pole, " sq. rd.
 40 Rods make 1 Rood " R.
 4 Roods make 1 Acre, " A.
 160 Square rods make 1 Acre, " A.
 10 Square chains make 1 Acre, " A.
 640 Acres make 1 Square mile, " sq. mi.

NOTE. For practical exercise, 79 yards square may be considered an acre, though not strictly correct.

COMMON LIQUID MEASURE.

- 4 Gills make 1 Pint, marked pt.
 2 Pints make 1 Quart " qt.
 4 Quarts make 1 Gallon, " gal.
 63 Gallons make 1 Hogshead, " hhd.

NOTE. A gallon contains 231 cubic inches.

CUBIC OR SOLID MEASURE.

- 1728 Cubic inches make 1 Cubic foot, marked cu. ft.
 27 Cubic feet make 1 Cubic yard, " cu. yd.
 128 Cubic feet make 1 Cord of wood.

NOTE. A Cord is a pile of wood 8 feet long, 4 feet wide and 4 high.

SURVEYOR'S MEASURE.

$7\frac{92}{100}$ Inches	make 1 Link, marked l.
100 Links	make 1 Chain, marked ch.
80 Chains	make 1 Mile.

TIME

60 Seconds (sec)	make 1 Minute, marked m.
60 Minutes	make 1 Hour, " hr.
24 Hours	make 1 Day, " d.
7 Days	make 1 Week, " w.
4 Weeks	make 1 Month, " mo.
12 Months	make 1 Year, " y.
365 Days	make 1 Year,

NOTE. The above table of time, though in common use, is incorrect in several particulars. In calculating *interest* the standard is 30 days to the month, and 12 months to the year. The number of days in each month may be readily remembered by the following lines.

"Thirty days hath September,
 April, June, and November;
 All the rest have thirty-one,
 Save February, which alone
 Hath twenty-eight; and it, in fine,
 One year in four hath twenty-nine."

EXAMPLES.

1. Reduce 2 years, 4-mo. and 25 days to days.

$$\begin{array}{r}
 \text{OPERATION.} \quad 2 \\
 \quad \quad \quad 12 \\
 \hline
 \quad \quad \quad 24+4=28 \text{ months.} \\
 \quad \quad \quad \quad 30 \\
 \hline
 \end{array}$$

$$840+25=865 \text{ days, Ans.}$$

NOTE. Multiply the years by 12 to reduce them to months, and add in months, then multiply by 30, and add in days, the result will be the correct number of days. If there are weeks reduce them to days by multiplying by 7, and add to days after reducing as above.

REDUCTION OF COMPOUND NUMBERS.

Compound numbers express units, of different kinds or denominations.

Reduction is the process of changing numbers from one denomination to another, without altering their values.

It is of two kinds, *Descending* and *Ascending*.

Reduction descending is the changing of numbers of a high denomination to a lower denomination; as bushels to pecks, &c. It is performed by multiplication.

Reduction ascending is the changing of a lower denomination to a higher; as pecks to bushels. It is performed by division.

DESCENDING REDUCTION.

RULE.

Multiply the highest denomination given by the number required of the next lower denomination, to make one of this higher, and to the product add the given number of this lower denomination. Proceed in this manner with each successive denomination, till you have come to the one required.

EXAMPLES IN AVOIRDUPOIS WEIGHT.

Reduce 2 cwt. 3 qr. 12 lbs. 8 oz. 10 drs. to drams.

OPERATION. $2 \times 4 = 8 + 3 = 11 \times 25 = 275 + 12 = 287$
 Wt. in drams.

$$\text{lbs.} \times 16 = 4592 + 8 \text{ oz} = 4600 \times 16 = 73600 + 10 \text{ drs} = 73610 \text{ drs. Ans.}$$

2. Reduce 7 cwt. 2 qr. 5 lbs. 12 drs. to drams.

Ans. 193292 drs.

3. Reduce 5 tons, 17 cwt. 3 qr. 18 lbs. to pounds.

Ans. 11793 lbs.

EXAMPLES IN LONG MEASURE.

1. In 70 miles how many furlongs and poles?

Ans. 560 fur. 22400 poles.

2. In 40 yards, how many feet and inches?

Ans. 120 feet, 1440 ins.

EXAMPLES IN CLOTH MEASURE.

1. In 14 yards, how many nails?

Ans. 224 na.

2. In 17 yards, 1 qr. 2 nails, how many nails?

Ans. 278 na.

EXAMPLES IN DRY MEASURE.

1. In 49 bushels, 3 pecks, 5 quarts, how many quarts?

Answer 1597 qts.

2. In 360 barrels and 2 bushels corn, how many pecks?

Answer, 7298 pks.

EXAMPLES IN LAND OR SQ. MEASURE.

1. In 40 acres how many poles?

Answer, 6400 poles.

2. In 17 acres, 3 roods, 10 poles, how many poles?

Answer, 2850 poles.

EXAMPLES IN LIQUID MEASURE.

1. In 17 gallons how many gills?

Ans. 544 gills.

2. In 4 hogsheads, how many qts ?

Answer, 1008 qts.

EXAMPLES IN CUBIC OR SOLID MEASURE.

1. In 20 cubic feet, 142 cubic inches, how many cubic inches ?

Answer, 34702 cubic inches.

2. In 75 cubic feet, how many cubic inches ?

Answer 129600 in.

EXAMPLES IN SURVEYOR'S MEASURE.

1. In 40 miles how many chains ?

Ans. 3200 chs.

2. In 40 chains, how many links ?

Answer, 4000 links.

EXAMPLES IN TIME MEASURE.

1. In 1 year, 2 months, 3 weeks, 4 days, how many days ?

Answer, 445 days.

2. How many hours in 2 years, 3 months, 4 weeks and 3 days ?

Answer, 20184 hours.

MISCELLANEOUS EXAMPLES IN REDUCTION.

1. How many bottles, that contain 3 pints each, will it take to hold a hogshead of wine ?

Answer, 168

2. There is a certain pile of wood 120 feet long, $\frac{1}{2}$ foot high, and 4 feet wide; what is the value at \$4.00 per cord ?

Answer, \$67.50

3. I have 4 cribs, which contain each, 150 barrels, how many pints in the 4 cribs ?

Ans. 192000 pints.

4. I have a barn 60 feet long, 30 feet wide, how many square yards in the floor?

Answer, 200 square yards.

5. How many acres in a field containing 8200 square rods?

Answer, $51\frac{1}{4}$ acres.

REDUCTION ASCENDING.

RULE.

Divide the given denomination by that number which it takes of this denomination to make 1 of the next higher. Proceed in this manner with each successive denomination, till you come to the one required. The last quotient, with the several remainders, will be the answer sought.

AVOIRDUPOIS WEIGHT.

EXAMPLES.

1. Reduce 73610 drams to higher denominations.

OPERATION. $73610 \div 16 = 4600$ oz. and 10 drams; then $4600 \div 16 = 287$ lbs. and 8 oz; then $287 \div 25 = 11$ qrs. and 12 lbs.; and $11 \div 4 = 2$ cwt. and 3 qrs.; hence 2 cwt. 3 qrs. 12 lbs. 8 oz. and 10 drams Ans.

2. Reduce 4 hundred weight, 1 quarter, 15 pounds to pounds.

Answer, 440 lbs.

3. Reduce 15 hundred weight, 3 quarters, 20 pounds to ounces.

Answer, 25520 ounces.

LONG MEASURE.

1. In 1440 inches how many yards?

Answer, 40

2. In 5025 rods how many miles?

Answer, 15 mi. 5 fur. 25 rds.

CLOTH MEASURE.

1. In 267 nails how many yards?

Answer, 16 yds. 2 qr. 3 na.

2. Reduce 224 quarters to yards.

Answer, 56 yards.

DRY MEASURE.

1. In 1597 quarts how many bushels?

Answer, 49 bushels, 3 pecks, 5 qts.

- Reduce 4511 pecks to barrels.

Answer, 225 barrels, 2 bu. 3 pks.

LAND MEASURE.

1. In 6400 rods how many acres?

Answer, 40

2. Reduce 2475 poles to acres.

Answer, 15 acres, 1 rod, 35 poles.

LIQUID MEASURE.

1. In 1008 quarts, how many hogsheads?

Answer 4

2. Reduce 510 gills to gallons.

Answer, 15 gal. 3 qts. 1 pt. 2 gills.

CUBIC OR SOLID MEASURE.

1. In 34702 cubic inches how many cubic feet?

Answer, 20 cu. feet, 142 cu. in.

2. Reduce 129600 cubic inches to cubic feet.

Answer, 75 cubic feet.

SURVEYOR'S MEASURE.

1. In 3200 chains, how many miles?

Answer 40

2. Reduce 126575 links to miles.

Answer, 15 mi. 65 ch. 75 links

TIME.

1. In 1011 days, how many years?
Answer, 2 y. 9 mo. 21 days.
2. Reduce 1000000 seconds to days.
Answer, 11 da. 13 hr. 46 min. 40 sec.
3. Reduce 2592000 seconds to months.
Answer 1 month.
4. Reduce 1705 days to years.
Answer, 4 yrs. 8 mo. 25 days.

MISCELLANEOUS EXAMPLES IN REDUCTION.

1. In 1250 half pints, how many gallons?
Answer 78 gallons, 1 pt.
2. Reduce 1560 pounds to hundred weight.
Answer, 15 cwt. 2 qr. 10 lbs.
3. In 9480 inches, how many yards?
Answer, 263 yards, 1 ft.
4. Reduce 720 gallons to hogsheads.
Answer, 11 hhds. 27 gals.
5. In 5012 pecks how many barrels?
Answer, 250 bbls. 3 bu.
6. Reduce 6811 pecks to barrels.
Answer, 240 bbls. 2 bu. 3 pks.
7. In 8415 solid feet how many cords?
Answer, 65 cords, 95 cubic ft.
8. In 9495 quarters of dollars how many dollars?
Answer, \$2373 $\frac{3}{4}$

FRACTIONS.

A *fraction* is a part of a whole number.

A *vulgar fraction* is any division of a unit into parts expressed by a *numerator* and *denominator*, as $\frac{4}{5}$ or $\frac{2}{3}$.

The *denominator* is the *lower part* of every fraction and *denominates* the number of parts into which the unit is divided.

The *numerator* is the *upper part* of every fraction and *numbers* the parts taken.

There are four kinds of fractions in common use—Proper, Improper, Mixed and Compound.

A *proper fraction* is one whose *numerator* is less than its *denominator*,—as $\frac{5}{12}$; an *improper fraction* is one whose *numerator* is larger than its *denominator*,—as $\frac{8}{3}$; a *mixed fraction* (or *number*) is a *whole number* and a *fraction*, as $4\frac{2}{3}$; a *compound fraction* is a *fraction* of a *fraction*, as $\frac{2}{3}$ of $\frac{5}{8}$ or $\frac{2}{3} \times \frac{5}{8}$.

ADDITION OF FRACTIONS.

RULE.

Reduce them to a common denominator by multiplying each numerator by all the denominators except its own, and add all the products together, and under the sum, place the product of all the denominators, then reduce to lowest term by dividing both the numerator and denominator by any number that will divide them without a remainder.

EXAMPLES.

1. Add $\frac{2}{3}$, $\frac{5}{7}$, $\frac{5}{12}$. denominators.
 OPERATION. $2 \times 8 \times 12 = 192$ $3 \times 8 \times 12 = 288$ product.
 $7 \times 3 \times 12 = 252$
 $5 \times 8 \times 3 = 120$
 sum $\overline{564}$

$$\begin{array}{r} 288 \overline{) 564} \quad (1\frac{33}{24} \text{ Ans.} \\ \underline{288} \\ 12 \overline{) 133} = 11\frac{3}{4} \end{array}$$

2. Add $\frac{2}{3}$, $\frac{4}{5}$ and $\frac{5}{6}$ Ans. $2\frac{23}{60}$

3. Add $\frac{1}{9}$, $\frac{2}{11}$ and $\frac{1}{4}$ Ans. $\frac{15}{96}$

4. Add $\frac{1}{2}$, $\frac{3}{5}$ and $\frac{4}{7}$ Ans. $1\frac{47}{70}$

5. What is the sum of $\frac{6}{7}$, $\frac{3}{8}$ and $\frac{9}{10}$? Ans. $2\frac{37}{80}$

TO ADD MIXED NUMBERS.

RULE.

Add the whole numbers first, then the fractions by above rule, and add the sum of the fractions to the sum of the whole numbers.

EXAMPLES.

1. Add $4\frac{1}{2}$, $3\frac{4}{5}$ and $7\frac{1}{10}$ Ans. $15\frac{2}{5}$
 OPERATION. $4 + 3 + 7 = 14$. $\frac{1}{2} + \frac{4}{5} + \frac{1}{10} = \frac{14}{10}$ or $1\frac{2}{5}$

Then $14 + 1\frac{2}{5} = 15\frac{2}{5}$ Ans.

2. Add $8\frac{3}{4}$ and $7\frac{5}{8}$ Ans. $16\frac{5}{12}$

3. Add $17\frac{1}{2}$, $24\frac{1}{5}$ and 8 Ans. $49\frac{7}{10}$

4. What is the sum of $7\frac{3}{4}$, $8\frac{3}{4}$ and $10\frac{7}{12}$? Ans. 27

5. $12\frac{3}{4} + 15\frac{5}{8} + 25\frac{1}{2} + 30\frac{1}{5} =$ what sum? Ans. $84\frac{19}{80}$

SUBTRACTION OF FRACTIONS.

RULE.

Reduce them to a common denominator, by multiplying each numerator by the denominator of the other fraction, and take the difference of the products and under the difference place the products of the denominators.

EXAMPLES.

1. From $\frac{4}{5}$ take $\frac{3}{7}$ Ans. $\frac{17}{40}$
 OP. $4 \times 8 = 32$ $5 \times 8 = 40$ product of denominators
 $3 \times 5 = 15$ which place under $17 = \frac{17}{40}$ Ans.
 —————
 17 dif.

2. From $\frac{14}{15}$ take $\frac{3}{5}$ Ans. $\frac{1}{3}$

3. Subtract $\frac{2}{5}$ from $\frac{8}{17}$ Ans. $\frac{6}{85}$

4. Take $\frac{6}{8}$ from $\frac{9}{7}$ Ans. $\frac{19}{72}$

5. From $\frac{16}{15}$ take $\frac{15}{16}$ Ans. $\frac{31}{240}$

NOTE. When mixed numbers occur, reduce them to improper fractions by multiplying the whole number by the denominator of the fraction, and adding in the numerator, and under the result place the denominator, then subtract by the above rule.

EXAMPLES.

1. From $7\frac{2}{3}$ take $6\frac{1}{2}$ Ans. $1\frac{1}{2}$

OP. $7 \times 3 = 21 + 2 = \frac{23}{3}$ $6 \times 4 + 3 = \frac{27}{4}$

Then $\frac{23}{3} - \frac{27}{4} = \frac{92}{12} - \frac{81}{12} = \frac{11}{12}$ Ans.

2. From $9\frac{4}{5}$ take $8\frac{1}{3}$ Ans. $1\frac{7}{15}$

3. Take $7\frac{1}{5}$ from $8\frac{2}{3}$ Ans. $\frac{19}{30}$

4. Subtract $6\frac{1}{4}$ from $25\frac{1}{2}$ Ans. $19\frac{1}{4}$

5. Take $5\frac{1}{4}$ from $17\frac{5}{8}$ Ans. $12\frac{1}{2}$

MULTIPLICATION OF FRACTIONS.

RULE.

Draw a vertical line and place the numerators on the right and the denominators on the left.

If mixed numbers occur reduce them to improper fractions and proceed as above. For operation, see Caution below.

CAUTION. Never set down mixed numbers in the statement. Always reduce them to improper fractions, and place the numerators where the mixed numbers belong, and place the denominators on the opposite side of the vertical line, always.

Be sure to mark out every figure as you use it, lest you use it again. After you get your question stated, commence dividing across the vertical line either way, if possible without a remainder. Then multiply all the unmarked figures on the right together and divide by those on the left, either separately or multiplied together.

EXAMPLES.

1. Multiply $\frac{4}{5}$ by $1\frac{5}{8}$ Ans $\frac{3}{2}$

$$\begin{array}{r|l} \text{OP. } 5 & 4 \\ 4 & 15 \\ \hline 4 & 3 \div 4 = 3 \end{array} \text{ Ans.}$$

2. Multiply $\frac{3}{5}$ of $\frac{5}{6}$ by $2\frac{4}{7}$ Ans $\frac{4}{9}$

3. $\frac{2}{3} \times \frac{5}{8} \times \frac{8}{15} \times 1\frac{1}{2} \times 6$ Ans. $\frac{1}{2}$

4. $\frac{18}{19} \times \frac{5}{6} \times \frac{19}{20} \times 5$ Ans. $3\frac{3}{4}$

5. $\frac{8}{7} \times \frac{4}{7} \times \frac{5}{7} \times 9$ Ans. $5\frac{1}{7}$

6. $\frac{5}{6} \times \frac{4}{5} \times \frac{3}{4} \times \frac{2}{3} \times \frac{1}{2}$ Ans. $\frac{1}{6}$
 7. $\frac{4}{9} \times \frac{7}{12} \times \frac{9}{14} \times 1\frac{9}{7} \times \frac{38}{38}$ Ans. $\frac{7}{81}$
 8. Multiply $\frac{2}{3}$, $\frac{1}{2}$, $\frac{5}{9}$, $\frac{7}{15}$, $\frac{9}{14}$ and 8 together. Ans. $\frac{2}{3}$
 9. $\frac{11}{18} \times \frac{16}{14} \times \frac{7}{11} \times \frac{33}{38} \times 56$ Ans. 14

TO MULTIPLY MIXED NUMBERS.

RULE.

Reduce them to improper fractions and proceed as above.

EXAMPLES.

10. Multiply $8\frac{1}{2}$ by $5\frac{1}{2}$ Ans. 45
 Op. $8\frac{1}{2}$ to an improper fraction $= \frac{17}{2}$ $\frac{35}{2}$
 $5\frac{1}{2}$ to an improper fraction $= \frac{11}{2}$ $\frac{38}{2}$
 $9 \times 5 = 45$ Ans.
 11. What will $18\frac{1}{2}$ yds. cloth cost at $7\frac{1}{2}$ cts. per yd? Ans. \$143 $\frac{1}{2}$
 12. What will $7\frac{1}{2}$ lbs. coffee cost at $12\frac{1}{2}$ cts per lb? Ans. 95 cts.
 13. $8\frac{1}{2} \times 3\frac{1}{2} \times 6\frac{1}{2}$ Ans. 188 $\frac{1}{2}$
 14. $16\frac{1}{2} \times 8\frac{1}{2}$ Ans. 140
 15. $\frac{1}{2} \times 2\frac{1}{2} \times 7\frac{1}{2}$ Ans. 13 $\frac{1}{2}$
 16. What will $17\frac{1}{2}$ barrels corn cost at \$3 $\frac{3}{4}$ per bbl? Ans. \$63
 17. What cost $62\frac{3}{4}$ bushels wheat at \$1 $\frac{1}{2}$ per bu? Ans. \$70
 18. What cost $30\frac{5}{8}$ yards cloth at \$2 $\frac{1}{2}$ Ans. \$67
 19. What cost $\frac{2}{3}$ of $\frac{1}{4}$ of 50 lbs. sugar at $12\frac{3}{4}$ cts. per pound? Ans. \$3.15
 20. What cost $4\frac{1}{2}$ of $4\frac{2}{3}$ of $6\frac{1}{2}$ of $4\frac{8}{9}$ yds. cloth at $2\frac{1}{3}$ cts. per yd? Ans. \$17.49

DIVISION OF FRACTIONS.

RULE.

Place the numerators of the dividends, and the denominators of the divisors on the right of the vertical line, and the denominators of the dividends and the numerators of the divisors on the left. If mixed numbers occur, proceed as directed under head of "Multiplication of Fractions."

EXAMPLES.

1. Divide $\frac{1}{2}$ by $\frac{1}{4}$ Ans. 2

$$\begin{array}{r|l} \text{Op} & \frac{1}{2} \bigg| \frac{1}{4} \\ & \frac{1}{4} \bigg| \frac{1}{2} \\ & 2 \text{ Ans.} \end{array}$$

2. Divide $\frac{1}{8}$ by $\frac{1}{7}$ Ans. $\frac{7}{8}$

3. Divide $\frac{1}{2}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{1}{4}$ Ans. $\frac{2}{3}$

4. Divide $\frac{7}{8}$ of $\frac{7}{9}$ of 8 by $\frac{4}{5}$ of $\frac{8}{12}$ of 6 Ans. $1\frac{1}{2}$

5. Divide $\frac{2}{7} \times \frac{8}{9} \times \frac{1}{2} \times \frac{9}{28}$ by $\frac{5}{11} \times \frac{2}{3} \times \frac{2}{5}$ Ans. $\frac{2}{7}$

NOTE. If mixed numbers occur, reduce to improper fractions, and proceed as above.

EXAMPLES.

6. Divide $4\frac{1}{9}$ by $\frac{5}{9}$ of $\frac{1}{15}$ Ans. 30

$$\text{Op } 4\frac{1}{9} = \frac{37}{9}$$

$$\begin{array}{r|l} \text{Then state} & \frac{37}{9} \bigg| \frac{10}{3} \\ & \frac{10}{3} \bigg| \frac{37}{9} \\ & \frac{10}{3} \bigg| \frac{37}{9} \\ & 3 \times 10 = 30 \text{ Ans.} \end{array}$$

7. Divide 12 by $\frac{3}{4}$ Ans. 16

8. Divide $68\frac{1}{2}$ by $34\frac{1}{2}$ Ans. 2

9. Divide $40\frac{1}{2}$ by $2\frac{1}{2}$ Ans. $14\frac{8}{11}$

10. $7\frac{1}{2} \div 2\frac{1}{2}$ Ans. $3\frac{1}{3}$

11. A man bought $13\frac{1}{2}$ lbs. sugar for $94\frac{1}{2}$ cts.; how much did his sugar cost him per lb? Ans. 7 cts.

12. If a man has but $87\frac{1}{2}$ cts. to buy coffee at $16\frac{1}{4}$ cts. a lb. how many lbs. will he get? Ans. $5\frac{5}{13}$

PROMISCUOUS EXERCISE IN FRACTIONS.

1. Add $\frac{1}{2}$ and $\frac{7}{8}$ together. Ans. $1\frac{3}{8}$

2. Add $\frac{1}{2}$ of $\frac{7}{8}$ and $\frac{3}{4}$ of $\frac{1}{2}$ together. Ans. $1\frac{17}{40}$

3. Add $\frac{3}{4}$ and $17\frac{1}{2}$ together. Ans. $18\frac{1}{6}$

4. From $\frac{3}{4}$ of $\frac{3}{4}$ take $\frac{1}{2}$ of $\frac{2}{3}$ Ans. $\frac{1}{3}$

5. From $\frac{6}{7}$ of 24 take $\frac{6}{9}$ of 27 Ans. $24\frac{2}{7}$

6. Multiply $\frac{9}{14} \times \frac{1}{6} \times \frac{5}{3} \times \frac{7}{3} \times \frac{8}{40} \times \frac{2}{7}$ Ans. $\frac{1}{18}$

7 Divide $\frac{1}{4}$ of 38 by $\frac{2}{3}$ of $6\frac{1}{2}$ and multiply the quotient by $\frac{8}{12}$ of 2 Ans. 6

8. Divide $\frac{4}{9}$ of $\frac{3}{4}$ by $\frac{2}{7}$ of $\frac{6}{9}$; multiply the quotient by $\frac{4}{7}$ of $\frac{8}{9}$ of 2 ; divide the product by $\frac{4}{5}$ of $\frac{7}{8}$ of $9\frac{1}{2}$; multiply the quotient by $\frac{3}{40}$ of 360 Ans. 48 ,

9. Multiply $\frac{7}{8}$ of $\frac{14}{42}$ of $\frac{8}{56}$ of $16\frac{1}{2}$, by $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{3}{8}$ of 49 Ans. $\frac{69}{160}$

10. If a railroad car should run $41\frac{1}{2}$ miles per hour how far would it go in 12 days, running $10\frac{1}{2}$ hours per day? Ans. 5229 miles.

11. How many chickens can I purchase for \$14, at \$3 $\frac{1}{2}$ per dozen? Ans. 48

12. Four men bought $\frac{2}{3}$ of $\frac{3}{4}$ of $4\frac{4}{5}$ lbs. of sugar at 8 cts. per pound, and divided it equally between them, how much had each to pay? Ans. $4\frac{4}{5}$ cts.

13. How many bushels of oats can I purchase with \$7 $\frac{1}{2}$ at 37 $\frac{1}{2}$ cts per bushel? Ans. 20 bushel.

14. If I have 15 remnants of cloth, each containing $2\frac{7}{10}$ yards, worth 9 $\frac{1}{2}$ cts. per yard; and 16 other remnants, each containing $3\frac{1}{2}$ yards, worth $10\frac{1}{2}$ cts. per yard, how much are all my remnants worth?

Ans. \$9.12 $\frac{3}{4}$

SINGLE RULE OF THREE.

RULE.

Place that number for the third term, which is of the same kind as the answer required. Put the term of demand, or the term which has "what" to it in the enunciation, in the second place; and the remaining term in the first place. Multiply the second and third terms together, and divide the product by the first, or divide the second or third by the first, and multiply the quotient by the remaining term.

Or, draw a verticle line and place the first term on the left, and the second and third on the right, and then work by cancellation. Should mixed numbers occur, see caution, page 35.

EXAMPLES.

1. If 4 hats cost \$20, what will 16 hats cost?

Ans. 80

$$\begin{array}{r|l} \text{OP. } 4 & 20 \\ & 16 \\ \hline & 4 \times 20 = \$80 \text{ Ans.} \end{array}$$

2. If a pole 13 feet high, cast a shadow 39 feet, what will be the length of a shadow made by a tree 120 feet high?

Ans. 360 feet.

$$\begin{array}{r|l} \text{OP. } 13 & 39 \\ & 120 \\ \hline & 3 \\ \hline & 360 \text{ feet Ans.} \end{array}$$

3. If 45 acres cost \$450, what will 78 acres cost?

Ans. \$780

Op. $45 \mid \begin{array}{l} 450 \\ \$780 \end{array}$ Ans.

4. If 36 acres cost \$720, what will $20\frac{1}{2}$ acres cost?

Ans. \$410

5. If 25 acres cost \$125, what will $17\frac{2}{3}$ acres cost?

Ans. \$88 $\frac{1}{3}$

6. If $16\frac{1}{2}$ yards of cloth cost \$19 $\frac{1}{2}$, what will $13\frac{1}{2}$ yards cost?

Ans. \$16 $\frac{1}{2}$

7. If 1 year's board cost \$108, what will 4 month's board be worth?

Answer, \$36

8. If 90 bushels of oats feed 40 horses for 6 days, how long will 450 bushels feed them?

Answer, 30 days.

9. If 30 barrels of flour will support 100 men for 40 days, how long will it subsist 25 men?

Answer, 160 days.

10. If 12 men can do a piece of work in 20 days, how long would it take 6 men?

Answer, 40 days.

11. If 3 men can perform a piece of work in 51 days, how many must be added to the number to perform the same work in 17 days?

Answer 6 men.

12. If whiskey sells at 80 cents per gallon, when corn is worth 50 cents per bushel, what will it bring when corn is 45 cents per bushel?

Answer, 72 cents.

13. If I sell 65 gallons of whiskey, when corn is

worth 50 cents per bushel, for \$80, how many gallons can I sell for the same, when corn is 80 cents per bushel ?

Answer, $40\frac{1}{2}$ gallons.

14. If $4\frac{1}{2}$ yards of cloth cost $\$11\frac{1}{4}$, what will $12\frac{1}{3}$ yards cost ?

Answer, \$32

15. If a stack of hay will keep a cow 20 weeks, and a horse 15 weeks, how long will it keep them both together ?

Answer, $8\frac{1}{2}$ weeks.

16. A fox is 96 rods before a grey-hound, and while the fox is running 15 rods, the grey-hound will run 21 rods ; how far will the dog run before he will catch the fox ?

Answer, 336 rods.

NOTE. In such questions, we take the difference of speeds, and say as that difference is to the greater speed, so is the distance ahead to the answer. Thus, $21 - 15 = 6 : 21 :: 96$ to the answer.

17 A fox has 150 rods the start of a hound, but the hound runs 8 rods while the fox runs 5 rods ; how far must the hound run before he catches the fox ?

Answer, 400 rods.

18. "A cunning fox was bounding at a rapid pace,
When upjumped a rabbit which he gave a chase;
Just 60 yards were there between
The fox and rabbit by us seen ;
As the cunning fox jumped eleven feet,
The rabbit made 8 in quick retreat,
Now, James, tell me how far the rabbit run,
Before the cunning fox upon him sprung ?"

Answer, 220 yards.

19. John and James departed from the same place,

and traveled the same road ; but John left 10 days before James, and traveled 20 miles per day. James followed at the rate of 30 per day, how far and how long must James travel to overtake him?

Answer, 600 miles, and 20 days.

20. If 360 men be placed in a garrison, and have provisions for 6 months, how many men must be sent away at the end of 4 months, that the remaining provisions may last these remaining 8 months?

Answer, 270 men.

21. How many yards of carpeting will it take to cover a floor that is 20 feet long and 18 feet wide, provided the carpeting is 2 feet and 6 inches in width?

Answer, 48 yards.

RULE FOR ALL SUCH QUESTIONS.—*Draw a vertical line and place the length and width of the floor in feet and 4 on the right—and the width of the carpeting in inches on the left. Then cancel.*

Ex. 21, above. Width of carpet, 2 ft. 6 in.=30 inches.

$$\begin{array}{r|l} \text{Op.} & 30 \\ 20 & 48 \\ 18 & 4 \\ \hline & 6 \times 4 \times 2 = 48 \text{ yards Ans.} \end{array} \left. \begin{array}{l} 30 \\ 48 \\ 4 \end{array} \right\} \text{width of floor.}$$

EXPLANATION. The 30 inches= $\frac{3}{4}$ of a yard, which divided by 9 sq. ft.= $\frac{3}{4}$ sq. ft. in 1 yard in length of the carpeting, which, divided into the sq. ft. to be covered, will give the yards.

22. How many yards of carpeting, 2 feet 9 inches wide, will be required to cover a floor 27 feet 6 inches by 21 feet?

Answer 70 yds.

23. How many yards of carpeting, $\frac{3}{4}$ yard wide, will carpet a floor 18 by 15?

Answer, 40

24. We have 4 rooms 16 feet square, to be covered with carpeting 2 feet 8 inches wide, how many yards will we have to buy? Answer, 128

25. If you buy carpeting, 2 feet 4 inches wide, at \$1½ per yard, what will it cost you to carpet 4 rooms 14 feet long and 12 feet wide? Answer, \$120

26. How many yards papering, that is 20 inches wide, will paper a room 16 feet square and 10 feet high? Answer, 128

NOTE. In such questions, get the sum of the sides and ends and multiply by the height, then proceed as in the carpet questions.

27. How many yards of papering, which is 1 foot 6 inches wide, will it take to paper a room 18 feet square, 12 feet high, provided one sixteenth of the room be taken up by windows and doors?

Answer, 180

PROMISCUOUS QUESTIONS IN PROPORTION

28. If a field containing 25 acres, produce 250 bushels, what will 5 acres produce?

Answer, 50 bushels.

Op. $\begin{array}{c|c} 25 & 250 \\ \hline 5 & \end{array}$ Ans.

29. If 5 horses eat 10 bushels of oats, how many bushels will it take to serve 10 horses?

Answer, 20 bus.

30. If 4 men, in 8 days, can do a piece of work, what length of time will it take 2 men to do it?

Answer, 16 days

31. If 20 bundles of fodder weigh 25 pounds, what will 650 bundles weigh? Answer, $812\frac{1}{2}$ lbs.

32. If a staff 6 feet high cast a shade 9 feet, what is the height of a steeple, whose shade measures at the same time 198 feet? Answer, 132 feet.

33. If 20 bushels of corn weigh 1120 pounds, what will 60 bushels weigh? Answer, 3360 lbs.

34. If 7 and 9 were 12, what, on the same supposition, would 8 and 4 be? Answer, 9.

35. If a certain vessel has provisions sufficient to last a crew of 10 men 45 days, how long would the provisions last, if the vessel were to ship 5 new hands? Answer, 30 days.

36. What quantity of muslin, that is $\frac{3}{4}$ of a yard wide, will line $6\frac{1}{2}$ yards of cloth, that is $1\frac{1}{2}$ yards wide? Answer, 13 yards.

37. How many pieces of marble will it take to build a wall around the Bank in Athens, when they are 10 inches long, 9 inches broad, and 4 inches thick, allowing the wall to be 80 feet long, 20 high and $2\frac{1}{4}$ feet thick? Ans. 17280 pieces.

38. How many pieces of marble will lay a floor 20 feet long, 16 feet wide, if the pieces are 8 inches square? Answer, 720 pieces.

39. A messenger, traveling 8 miles an hour, was sent to Mexico, with dispatches for the army; after he had gone 51 miles, another was sent with counter-manding orders, who could go 19 miles as quick as the former could go 16; how long will it take the

latter to overtake the former, and how far must he travel ? Answer, 34 hours 323 miles.

40. Bought a piece of land $45\frac{1}{2}$ rods long and $28\frac{4}{5}$ rods wide, at the rate of \$75 for $2\frac{1}{2}$ acres, what did it cost me ? Answer, \$274.50

41. If $2\frac{1}{2}$ times $2\frac{1}{2}$ yards of cloth, which is $1\frac{3}{4}$ times $1\frac{3}{4}$ qrs. wide, cost $4\frac{1}{6}$ times $8\frac{2}{5}$ dollars, what will $11\frac{3}{4}$ times $1\frac{5}{8}$ yards cost, which is $2\frac{1}{4}$ times $1\frac{1}{4}$ qrs. wide ?
Ans. \$90.

42. A number, consisting of 354 men, are to be clothed, each suit to contain $3\frac{3}{4}$ yards of cloth, that is $1\frac{1}{2}$ yards wide, and to be lined with Halland that is $\frac{3}{4}$ yards wide, how many yards will line them ?

Answer, $2212\frac{1}{2}$ yds.

43. We have 4 rooms to be papered—2 are 10 by 12 feet, 8 feet high,—2 are 15 by 18 feet, 10 feet high. If our paper is 1 foot 10 inches wide, how many yards will it take, and what will it cost at 05 cents per yard ?

Answer, 368 yds. and \$18.40

DOUBLE RULE OF THREE.

RULE FOR WRITING QUESTIONS.

Put the *living* or *moving* term in the *first place*; *time* or *distance*, in the *second place*; and the *other term* of demand in the *third place*; put the *other terms* under those of the same name. Having thus written the question, notice where the *blank* is.

RULE FOR STATING QUESTIONS.

If the *blank* is under the *third* term, put the *first* and *second* on the left of the vertical line, and the *other three terms* on the right; but if the *blank* is not under the *third*, put the *third* and *fourth*, on the left, and the other three on the right. In all cases where a *partially blank* term occurs, it must be placed on the left.

NOTE. If fractions or mixed numbers occur, see caution, page 35.

EXAMPLES.

If 4 men, in 8 days, mow 32 acres of grass, how many acres would 12 men mow, in 10 days?

Question written men days acres.

$$\begin{array}{r} \\ \\ \\ \\ \\ \\ \\ \\ \\ \end{array}$$

2. If 8 men have \$32 for 4 days work, how much will 48 men have for 16 days work?

Answer, \$768

3. If \$700 in a half year raise \$14 interest, how much will \$400 raise in 5 years?

Answer, \$80

4. If 5 men make 120 pair of shoes in 24 days, how many men will it require to make 300 pair in 15 days?

Answer, 20 men.

5. If 18 horses eat 128 bushels of oats in 32 days, how many bushels will 12 horses eat in 64 days.

Answer, 170;

6. If 6 men can dig a ditch 20 rods long, 6 feet deep and 5 feet wide, in 16 days, working 9 hours each day, how many days will it take 24 men to dig a ditch 200 rods long, 8 feet deep and 6 feet wide, working 8 hours per day? Answer, 90 days.

7. If 3 pounds of yarn will make 10 yards of cloth $1\frac{1}{2}$ yard wide, how many pounds will be required to make a piece 100 yards long, and $1\frac{1}{4}$ yards wide? Answer, 25 lbs.

8. If \$500 in 2 years gain 42 dollars, how much would 90 dollars gain in 4 years?

Answer, \$25.20

9. If 40 dollars, in 4 years and 6 months, gain 18 dollars, what sum will gain 30 dollars in 5 years?

Answer, \$60

10. If 8 horses consume 208 bushels in 52 days, how many bushels would 12 mules consume in 30 days each mule eating $\frac{5}{6}$ as much as a horse?

Answer, 150 bushels.

11. If in 6 days, $17\frac{1}{2}$ hours long, 16 men, with 13 mules, can excavate 312 yards in length, $15\frac{1}{2}$ yards in width, and $8\frac{3}{4}$ feet deep. how many mules will be required with 6 men, in $3\frac{3}{5}$ days of $16\frac{1}{2}$ hours long, to perform another excavation 50 $\frac{1}{2}$ yards long, 10 $\frac{1}{2}$ yards in width, and $15\frac{1}{2}$ feet deep?

Answer, 12 mules,

12. If 112 men, in 11 days of 11 hours each, dig a trench of 7 degrees of hardness, $232\frac{1}{2}$ feet long, $3\frac{3}{4}$ wide, 2 $\frac{1}{2}$ deep, in how many days of $5\frac{1}{2}$ hours

long, will 56 men dig a trench of 5 degrees of hardness, 465 feet long, $5\frac{1}{5}$ wide, and $3\frac{1}{2}$ deep?

Answer, 144 days.

13. If 15 dollars be the hire of 8 men for 3 days, how many days must 20 men work for 150 dollars?

Answer, 12 days.

14. If a horse can travel 120 miles in 4 days, when the days are 8 hours long, how far can he travel in 30 days, when the days are 10 hours long?

Answer, 1125 miles.

15. If 36 men, working 9 hours a day for 4 days, can dig a ditch 120 feet long, 8 feet wide, and 6 feet deep, what would be the depth of a ditch dug by 18 men in 3 days, 6 hours a day, the length being 60 feet, and the width 6 feet?

Answer, 4 feet.

16. If 5 compositors, in 16 days 11 hours long, can compose 25 sheets, of 24 pages in each sheet, 44 lines on a page, and 40 letters in a line, in how many days, 10 hours long, can 9 compositors compose a volume (to be printed on the same kind of types) consisting of 36 sheets, 16 pages to a sheet, 50 lines on a page and 45 letters in a line?

Answer, 12 days.

INTEREST.

INTEREST is a compensation for the use of borrowed money.

The *principal* is the sum on which interest is computed.

The *amount* is the *principal* and *interest* added together.

The *rate per cent.* is so much on the hundred.

RULE.

When the time is years, or years and months, it must be reduced to months. When it is years, months and days, it must all be reduced to days. Draw a vertical line, and on the right place, first, the principal, second, the rate per cent. third, the time, all directly underneath each other; and place 12 or its factors on the left, if the time is months, or 36, or its factors, if the time is days.

After the example is thus stated, commence dividing across the line either way, if you can, without a remainder. But if you cannot divide without a remainder, multiply all on the left into themselves, and those on the right into themselves, and then divide the one by the other, and the quotient will be answer in dollars, cents and mills. Be careful to write the quotient underneath the dividend.

When the time is months and there are cents in

the principal, point off four figures, but if no cents, point off two. Also when the time is days, and there are cents in principal, point off five figures, but if no cents, three.

NOTE. If fractions or mixed numbers occur, see caution, page 35.

EXAMPLES.

1. What is the interest of \$24, at 7 per cent. for 12 months?

$$\begin{array}{r|l} \text{Op. } 12 & 24 \times 7 = \$1.68 \text{ Ans.} \\ & 7 \\ & 12 \end{array}$$

2. What is the interest of \$21, at 7 per cent. for 8 months?

$$\begin{array}{r|l} \text{Op. } 8 & 21 \\ & 7 \\ & 8 \\ & 2 \times 7 \times 7 = 98 \text{ cts. Ans.} \end{array}$$

3. What is the interest of \$60, at 7 per cent. 1 year, 8 months?

$$\text{Op. } 1 \text{ year} \times 12 = 12 \times 8 = 20 \text{ mos.}$$

$$\begin{array}{r|l} 60 & 60 \\ 20 & 7.00 \text{ Ans.} \\ & 20 \end{array}$$

4. What is the interest of \$40, at 7 per cent. 2 years and 6 months? Answer, \$7

5. What is the interest of \$420, at 8 per cent. for 4 years? Answer, \$134.40

6. What is the interest of \$120, at 6 per cent. for 3 years, 9 months? Answer, \$27

7. What is the interest of \$75, at 4 per cent, for 3 years, 6 months? Answer, \$10.50

8. What is the interest of \$30, at 8 per cent. for 17 months? Answer, \$3.40

9. What is the interest of \$60, at 14 per cent. for 19 months? Answer, \$13.30

10. What is the interest of \$21, at 10 per cent. for 8 months? Answer, \$1.40

11. What is the interest of \$10,000, at 8 per cent. for 3 months? Answer, \$200.00

12. What is the interest of \$700, at 15 per cent. for 16 months? Answer, \$140

13. What is the interest of \$400, at 9 per cent. for 300 days?

$$\begin{array}{r|l} \text{Op. } 4 & 400 \\ \text{\$/} & \text{\$/} \\ & \$30,000 \text{ Ans.} \end{array}$$

NOTE. Remember to cut off three figures for cents and mills, when there are no cents in the principal, if time is days.

14. What is the interest of \$90, at 6 per cent. for 400 days? Answer, \$6

15. What is the interest of \$110, at 8 per cent. for 2 years, 3 months and 20 days? Answer, \$20.28+

16. What is the interest of \$99, at 4 per cent. for 2 years, 6 months and 26 days?

Answer, \$10.18+

17. What is the interest of \$3.60 cents, at 6 per cent. for 11 months, 10 days? Answer, 20 cents.+

$$\begin{array}{r|l} \text{Op. } 3 & 360 \\ \text{\$/} & \text{\$/} \\ & 340 \times 6 \text{ 20.400 Ans. cents and mills.} \end{array}$$

11 mos. \times 30 + 10 days = 340 days

NOTE. See Rule for cents in principal.

18. What is the interest of \$12000000, at 1 per cent. for 3 days? Answer, \$1000

19. What is the interest of \$66 $\frac{2}{3}$, at 8 per cent. for 720 days? Answer, \$10.66+

20. What is the interest of 720 dollars, at 7 per cent. for 2 years, 1 month and 10 days? Answer, \$106.40

21. What is the interest of 90 cents, at 7 per cent. for 4 years and 20 days? Ans. 25+cents.

22. What is the interest of 19 $\frac{3}{5}$ dollars, at 6 per cent. for 1 year, 1 month and 18 days?

Answer, \$1.+

23. What is the interest of \$240, at 7 per cent. from June the 19th, 1840, to July 1st, 1841?

Answer, \$17.36

NOTE. Write the earlier date under the later, placing the years on the left, the number of the months next, and the day of month on the right, then take their difference, and then reduce as before directed.

24. What is the interest of \$276, at 7 per cent. from March the 14th, 1858, to August the 8th, 1860?

Answer, \$46.36+

25. What is the interest of \$36.72 cts. at 7 per cent. from Feb. 13th, 1859, to Nov. 28th, 1860?

Answer, \$4.60+

26. What is the interest on a note given on the 2d Jan. 1860, for \$450, at 7 per cent. and paid on the 30th November, 1860? Answer, \$28.70

\$720.

ATHENS, Ga., Jan. 15, 1858.

27 One day after date, I promise to pay John G.

Roe, or bearer, seven hundred and twenty dollars
for value received. RICHARD PAYWELL.

At 7 per cent, what was due October the 5th, 1860?

Amount due, \$857.20

PARTIAL PAYMENTS.

RULE.

Find the amount of the principal from the time it becomes due until the time of settlement. Then find the amount of each payment from the day it was paid in until the final settlement, and subtract their sum from the amount of the principal.

EXAMPLES.

\$2400 ELBERTON, Ga., 1st June, 1857

28. For value received, I promise to pay G. Nash, Esq., or bearer, two thousand four hundred dollars on demand, at 7 per cent. JOHN LUCKY, Jr.

Received on the above note

1st Oct., 1858, \$800.

What remains due at settlement, 25th Aug. 1860 ?

Answer, \$2036.80

OPERATION.

Principal.....\$2400.
Int. on prin. from date to set. (3 ys. 2 mo. 24 d.) \$543.20

Amount of principal.....\$2943.20

Payment.....\$800

Int. on payment from date to set.

(1 y. 10 mo. 24 d.).....\$106.40

Amount of payment.....\$906.40

Then \$2943.20—\$906.40=\$2036.80 due at final settlement.

NOTE. We have set down *results*. The student will do the *work*, and proceed with all the payments as with one.

\$720.36 ATLANTA, Ga., 15th Jan. 1858.

29. By the 20th August next, I promise to pay John H. Little, or bearer, seven hundred and twenty dollars and thirty-six cents, with interest from date, at 7 per cent.

M. P. CERTAIN.

Rec'd. on the "within" note \$480, 4th July, 1859.

What remains due 20th Nov. 1860?

Ans. \$337.64

PROP. 1st. To find the PRINCIPAL, when the *interest*, *rate per cent.* and *time* are given.

RULE.

Place the given time and rate per cent. on the left. The given interest, 100, and the standard, corresponding with given time in the question, on the right.

30. What principal at interest for 1 year and 8 months, at 9 per cent. will produce \$42?

1 year 8 months = $\frac{12}{20}$

OPERATION.	\$	42
		00
	20	12
	3	4
	\$	1400
		\$280 Ans.

31. A father bequeathed his son a fortune, the interest of which, at 7 per cent. amounted to \$700 annually, what was his fortune?

Ans. \$10,000

32. What principal at 6 per cent. will gain \$36 in 2 years?

Ans. \$300

33. William A. Merchant, loaned his money at 7 per cent. and received \$1200 interest a year, how much did he lend? Ans. \$17142.85+

PROP. 2. To find the **RATE PER CENT.** the *principal, interest and time*, being given.

RULE.

Place the principal and time on the left. On the right place the given interest, standard and 100.

NOTE. The 100 may be omitted if there are cen's in the interest and none in the principal, but if no cents occur in either, the 100 must be used on the right.

If cents occur in both principal and interest, place 100 on the right.

34. If the interest of \$300 for 2 years is \$48, what is the per cent?

$$\begin{array}{r|l}
 \text{OP. } 300 & 48 \\
 & 00 \\
 24 & 12 \\
 & 2 \\
 \hline
 & 24 \div 3 = 8 \text{ per cent. Ans.}
 \end{array}$$

35. A. has B's note for \$500, being on interest 2 years and 6 months, amounted to \$550, what was the rate per cent? Ans 4 per cent.

36. The interest of \$700 for 1 year, 6 months, is \$63, what is the rate per cent? Ans. 6 per cent.

37 If I pay \$8.82 for the use of \$72 for 1 year, 9 months, what is the rate per cent?

Ans. 7 per cent.

PROP. 3. To find the TIME, the *principal*, the *interest*, the *per cent.* being given.

RULE.

Place the principal and rate per cent. on the left, and the given interest and 12 on the right.

NOTE. If there are cents in the given principal place 100 on the right.

38. If the interest of \$140, at 6 per cent. is \$42, for how long a time was it on interest?

Ans. 60 months.

$$\begin{array}{r|l} \text{OP. } 140 & 42 \\ 6 & 100 \\ & 12 \\ \hline & 3 \times 2 \times 10 = 60 \text{ months Ans.} \end{array}$$

39. I loaned \$372 at 8 per cent. and received for interest \$17.36, how long was it out?

Ans. 7 months.

40. How long must \$165 be on interest, at 6 per cent. to gain \$14.85?

Ans. 18 months.

41. How long must \$25.60 be on interest at $12\frac{1}{2}$ per cent. to gain \$76.80?

Ans. 24 years.

COMPOUND INTEREST.

COMPOUND INTEREST is not only the *interest* on the *principal*, but also on the *interest* after it becomes due.

RULE.

Cast the interest on the given principal for 1 year, or specified time, and add to the principal; then cast the interest on the amount for the next year, or specified time, add it to the principal as before. Proceed in this manner with each successive year, or period of proposed time.

Finally subtract the given principal from the last amount, and the remainder will be the compound interest.

NOTE. State as in simple interest, page 49.

42. What is the compound interest of \$1200 for 2 years, at 7 per cent?

OPERATION.		First year.	
1st Statemt.	\$	1200	$\times 7 = 84.00$
		7	1200
		<hr/>	
		\$	\$1284
<hr/>			
		Second year.	
2d Statemt.	\$	1284	$\times 7 = 89.88$
		7	1284
		<hr/>	
		\$	1373.88 The amount.
			1200 Deduct given prin.
		<hr/>	
		Ans.	\$173.88 Compound interest!

43. What is the compound interest of \$350 for 4 years, at 6 per cent? Ans. \$91.86

DISCOUNT.

DISCOUNT is a deduction made as a compensation for paying money before it is due.

We will divide it into two propositions—*Present worth* and *Discount*.

PRESENT WORTH.

RULE.

On the right of vertical line place the principal and 100, and on the left, the amount of \$100 for the given time and rate per cent.

1. What is the present worth of \$128 due 4 years hence, at 7 per cent? Ans. \$100

EXAMPLES.

OPERATION.

$$\begin{array}{r|l}
 100 & \\
 7 \times 4 \times 100 = 28.00 & \\
 4\% & 100 \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r|l}
 128 & \\
 12\% & \\
 100 & \text{Present worth.}
 \end{array}$$

Amount 128

2. If I buy a horse for \$107, on 12 months' credit, what is the present worth, at 7 per cent?

Ans. \$100.

3. What is the present worth of \$256.50, due 2 years, 4 months hence, at 6 per cent?

Ans. \$225

4. What is the present worth of \$802.50 due 1 year hence, at 7 per cent?

Ans. \$750

5. What is the present worth of \$640.80, due 1 year and 4 months from date, at 6 per cent?

Ans. \$593.33½

DISCOUNT.

RULE.

On the left, place the amount of \$100 for the given time and rate per cent. ; and on the right, place the principal, with 100, and the interest of \$100, for the given time and rate per cent.

NOTE. The reason we place the *interest* of \$100, on the right is, that the *present worth* of any sum multiplied by the *interest* of \$100, for the given time and rate, must give the discount. The present worth of \$114 for 2 years at 7 per cent. = \$100, which multiplied by the interest of \$100 for the given time and rate equals the discount; thus, $100 \times 14 = \$14.00$

Ans.

EXAMPLES.

6. What is the discount on \$114 at 7 per cent. for 2 years? Ans. \$14

OP. ~~114~~ | ~~× 1400~~
\$14.00 discount.

7 What is the discount on \$140, at 8 per cent. for 5 years? Ans. \$40

8. What is the discount on \$130 for 5 years at 6 per cent? Ans. \$30

9. What is the discount on \$117.60, due 1 year hence, at 12 per cent? Ans. \$12.60

10. What is the discount on \$269.01, due in 2 years and 9 months, at 8 per cent? Ans. \$48.51

11. What is the discount on \$31 $\frac{1}{2}$ due 4 $\frac{1}{2}$ years hence, at 7 per cent? Ans. \$31.50

12. What is the discount of 608 dollars, due 1 month and 6 days hence, at 5 per cent?

PER CENTAGE.

PER CENTAGE is an *allowance* for every hundred, consisting of a part of that on which it is reckoned.

Per cent. is contracted from *per centum*, literally, *by the hundred*, so per centage being *by the hundred*, 100 is the standard.

1 PROP. To find the per centage gained or lost, on any sum or number at any rate per cent.

RULE.

Draw a vertical line and place the number and rate per cent. on the right, and 100, or its factors on the left. If fractions or mixed numbers occur, see caution, page 35.

EXAMPLES.

1. What is the per centage on 50 dollars at 8 per cent ?

Ans. \$4

$$\begin{array}{r|l} \text{Op.} & \text{\$0} \quad \text{\$0} \\ & \text{\$} \quad \text{8} \\ & \hline & \text{\$4} \text{ Ans.} \end{array}$$

2. If I collect for 7 per cent. what will be due me for collecting 440 dollars ?

Ans. \$30 $\frac{1}{2}$

3. If you employ a lawyer to collect \$2400, and he charges you 5 per cent. what is due him ?

Ans. \$120

4. What is 1 $\frac{1}{2}$ per cent. of 600 ?

Ans. 9

5. What is 2 $\frac{1}{2}$ per cent. of \$30.40 ?

Ans. 76 cents.

2 PROP. To determine the *gain* or *loss* per cent.

RULE.

Place the cost on the left, and the difference between the cost and sale on the right, with 100.

EXAMPLES.

6. If I buy a yard of cloth for 28 cts. and sell it for 35 cts. what per cent do I gain? Ans. 25

7 If a merchant gives 40 cts. for a knife, and sells it for 50 cts. what per cent. is gained?
Ans. 25

8. If J. R. Boone bought a hat at \$3.60, and sold it for \$4.50, what did he gain?
Ans. 25 per cent.

9. If a horse costs me 120 dollars, and one eye goes out; I have to sell him for 96 dollars, what per cent. lost? Ans. 20

10. If G. F. Platt buys molasses at 45 cts. per gallon, and sells at 81 cts. per gallon, what is his per cent?
Ans. 80

11. A man bought a cow for 25 dollars, which he afterwards sold for 29 dollars; what per cent. did he make?
Ans. 16

12. Bought sugar at 8 cts. a pound and sold it at 9 lbs. to the dollar; what is the gain per cent?
Ans. $38\frac{2}{3}$

13. If I buy corn at 3 dollars and 50 cts. a barrel, and sell it at 98 cts. a bushel, what is my gain?
Ans. 40 per cent.

14. If John buys a horse for 75 dollars, and

him for 100 dollars, what per cent. does he make?

Ans. 33½

15. If John buys a horse for 100 dollars, and sells him for 75 dollars, what per cent. does he lose?

Ans. 25

NOTE. It must be remembered that the *per centage* which is *gained* or *lost*, is always calculated on the *first cost*, or *purchase price*, and not on the *selling price*, as some often suppose.

3 PROP. To *put on per cent.* to find a selling price, to *gain* a given per cent.

RULE.

Draw a vertical line and place the cost on the right with 100 plus the given per cent; and 100 or its factors on the left.

EXAMPLES.

16. If I buy calico at 10 cts. a yard, at what price must I sell it to gain 40 per cent?

Ans. 14 cents.

OP. $\begin{array}{l|l} 10 & 10 \\ 10 & 140 \end{array}$ We add the 40 to the 100 and place it under the *cost*, and put factors of 100 on left.

17 We buy molasses at 40 cts, a gal. and wish to make 80 per cent. what will be our price?

Ans. 72 cents.

18. If Wheelchel & Dorsey buy gingham at 20 cts. per yard, and sell it at an advance of 30 per cent. what do they get per yard? Ans. 26 cents.

19. S. M. Goolsby bought vests at 2 dollars and 80 cts. apiece, and wishes to sell at 25 per cent gain, what will be his price? Ans. \$3.50

20. A merchant bought goods to the amount of 3400 dollars, and retailed them at 20 per cent. profit ; what did he make ?

Ans. \$680

21. A drover bought 175 sheep for 350 dollars, and sold them so as to gain 15 per cent ; how much did he sell them for per head ?

Ans. \$2.30

22. If you buy coffee at 10 cents a pound, how many pounds can you sell to the dollar, and make 25 per cent ?

Ans. 8 lbs.

4 PROP. To *take off* or *lose* a certain per cent. from the *first cost*, and leave the rest.

RULE.

Place the cost on the right, with 100 minus the given per cent. and 100, or its factors, on the left.

EXAMPLES.

23. I buy cloth at 20 cents a yard, and sell it at a loss of 10 per cent. what do I get per yard ?

Ans. 18 cents.

Op.	10		20	cost.
	10		90	dif. between 100 and per cent. lost.
			9 × 2 = 18 cents Ans.	

We reason thus : If we *lose* 10 per cent. we *retain* 90 per cent. which, being multiplied by the cost, will show what remains after a given per cent. has been lost.

24. Bought cloth at 12 cents a yard, and sold, losing 25 per cent. what did I get a yard ?

Ans. 9 cts.

25. If I buy muslin at 75 cents a yard, and am willing to lose 16 per cent. what will I sell it for?

Ans. 63 cts.

26. Bought 60 bushels of corn for 90 dollars; what must 1 bushel be sold at to lose 60 per cent?

Ans. 60 cts.

27. If a merchant buys 24 barrels of corn for 60 dollars, and by getting it damaged, has to lose 40 per cent. how much will he get for 1 bushel?

Ans. 30 cts.

28. A merchant bought 40 pounds of candy for 7 dollars and 20 cts. and sold at a loss of 15 per cent; what did he get a pound?

Ans. $15\frac{3}{10}$

5 PROP. To find the *cost* when a certain per cent. has been gained.

RULE.

To the right, place the selling price, with 100; on the left, 100 plus the per cent.

EXAMPLES.

29. Sold a book for 72 cents, and gained 20 per cent; what did it cost me

Ans. 60 cts.

OP. $12\phi \left| \begin{array}{l} 72 \div 12 = 6 \times 10 = 60 \\ 1\phi \\ 10 \end{array} \right.$ Ans.

30. J. R. Boone sells me a hat for 2 dollars and 50 cts. and tells me that he makes 25 per cent. what did it cost him?

Ans. \$2

31. Bought cloth at $3\frac{9}{10}$ dollars, whereby my

merchant made 15 per cent. what did he pay for it ?

Ans. \$3

32. Sold cloth at 15 cents, and made 20 per cent. what was first cost ?

Ans. $12\frac{1}{2}$ cents.

33. If R. L. Bloomfield sells me a coat for 16 dollars, and makes 44 per cent. what was the first cost ?

Ans. \$11 $\frac{1}{9}$

34. If A. B. C. Dorsey sells a man 20 lbs. coffee for 3 dollars and 12 cts. and clears 30 per cent. what was the first cost of 1 pound of the coffee ?

Ans. 12 cts.

35. John D. Simmons sold 75 bushels of corn for 55 dollars and 20 cts. and cleared 15 per cent. on first cost ; what did he pay for 1 barrel ?

Ans. \$3.20

6 PROP. To find the *first cost* when a certain per cent. has been *lost* by the sale.

RULE.

On the right, place the selling price with 100 ; and on the left, 100 minus the per cent.

EXAMPLES.

36. By selling a hat for 1 dollar and 20 cts. the merchant loses 20 per cent ; what was the first cost of the hat ?

Ans. \$1.50

$$\begin{array}{r|l} \text{OPERATION.} & \text{\$0} \quad | \quad \text{\$1.20} \\ & 20 \quad | \quad 25 \times 6 = 1.50 \text{ Ans.} \\ & 100 - 20 = 80 \quad | \quad 4 \end{array}$$

37 If, by selling flour at 4 dollars per barrel, I lose 20 per cent. what was the first cost ?

Ans. \$5

38. If W. N. White sells a book for 2 dollars and 25 cts. and loses 25 per cent. what did he give for it ?

Ans. \$3

39. Wilson & Bros. sell a shawl for 14 dollars, and lose $12\frac{1}{2}$ per cent. what was the first cost ?

Ans \$16

40. By selling my coffee at 8 lbs. to the dollar, I lose $12\frac{1}{2}$ per cent. on the first cost, what was the cost per pound ?

Ans. $14\frac{2}{7}$ cts.

MISCELLANEOUS EXERCISES IN PROFIT AND LOSS.

41. A horse that cost 84 dollars, having been injured, was sold for 75 dollars and 60 cts. what was the loss per cent ?

Ans. 10

42. If J. N. Glenn, should buy 120 gallons of molasses for 40 dollars, and 20 gallons leak out, at what price could he sell the rest per gallon to gain 10 per cent. on his purchase ?

Ans. 44 cents.

43. A. B. Pittman bought a quantity of wheat for 36 dollars, and by selling it at 1 dollar and 20 cts. a bushel, his gain was 30 per cent. how many bushels did he buy ?

Ans. 39

44. Pitner & England bought a hogshead of syrup for 50 dollars and 40 cts. but a number of gallons having leaked out. they sell the remainder at 90 cts. per gallon, and lose $10\frac{2}{7}$ per cent. on the cost ; how many gallons leaked out ?

Ans. 13 gallons.

45. Bought a box of cigars for 2 dollars and 50 cts. and by retailing them at 36 cents a dozen, my gain is 20 per cent. how many cigars in the box ?

Ans. 100

46. Hodgson & Bro. bought 50 barrels of flour at 9 dollars per barrel, but a part of it having been damaged, half of it was sold at a loss of 10 per cent. and the remainder at 9 dollars and 50 cts. per barrel ; what per cent. was lost on the cost by the transaction ?

Ans. $2\frac{2}{9}$ per cent.

PRACTICE.

PRACTICE is the method of working by or with the fractional or even parts of 10, or 100.

TABLE SHOWING THE FRACTIONAL PARTS.

FRACTIONAL PARTS OF 100.			FRACTIONAL PARTS OF 10.		
87½	is	$\frac{7}{8}$	9	is	$\frac{9}{10}$
75	is	$\frac{3}{4}$	8	is	$\frac{4}{5}$
62½	is	$\frac{5}{8}$	7	is	$\frac{7}{10}$
50	is	$\frac{1}{2}$	6	is	$\frac{3}{5}$
37½	is	$\frac{3}{8}$	5	is	$\frac{1}{2}$
33½	is	$\frac{1}{3}$	4	is	$\frac{2}{5}$
25	is	$\frac{1}{4}$	3½	is	$\frac{1}{3}$
20	is	$\frac{1}{5}$	2½	is	$\frac{1}{4}$
16⅔	is	$\frac{1}{6}$	2	is	$\frac{1}{5}$
12½	is	$\frac{1}{8}$			
10	is	$\frac{1}{10}$			

RULE.

To operate with any of the fractions, place the numerator where the whole number belongs, and the denominator on the opposite side of the line.

If the fraction is an even part of 100, annex two ciphers to the number to be multiplied, and divide

*by the number indicating the even part of 100,—
annex one cipher when the number is indicated by
an even part of 10.*

EXAMPLES.

1. What will 80 bushels corn cost at $87\frac{1}{2}$ cents per bushel? Ans. \$70

$$\begin{array}{r|l} \text{Op.} & \$0 \\ 87\frac{1}{2} = \frac{7}{8} & \$ \quad 7 \times 10 = \$70 \text{ Ans.} \end{array}$$

2. What will 96 yards of silk cost at $87\frac{1}{2}$ cents per yard? Ans. \$84

3. What will 400 bushels wheat cost at 75 cents per bushel? Ans. \$300

$$\begin{array}{r|l} \text{Op.} & \$ \\ 75 = \$\frac{3}{4} & \$300 \text{ Ans} \end{array}$$

4. What will 80 bus. of "White" peas cost at 75 cents per bushel? Ans. \$60

5. What will 80 bushels of "Jones" oats cost at $62\frac{1}{2}$ cents per bushel? Ans. \$50

$$\begin{array}{r|l} \text{Op.} & \$ \\ 62\frac{1}{2} = \frac{5}{8} & \$ \quad 5 \times 10 = \$50 \text{ Ans.} \end{array}$$

6. What will 21 yards of satinet cost at $62\frac{1}{2}$ cts. per yard? Ans. \$15

7. What will 1600 lbs. of fodder cost at 50 cents per hundred? Ans. \$8.00

$$\begin{array}{r|l} \text{Op.} & \$ \\ 50 \text{ cts.} = \frac{1}{2} & \$ \quad 8.00 \text{ Ans.} \end{array}$$

8. What will 96 yards of cloth cost at $37\frac{1}{2}$ cents per yard? Ans. 36

$$\begin{array}{r|l} \text{Op.} & \$ \\ 37\frac{1}{2} \text{ cts.} = \frac{3}{8} & \$ \quad 3 \times 12 = \$36 \text{ Ans} \\ & 12 \end{array}$$

9. What cost 16 yards of linen at $37\frac{1}{2}$ cts. per yard? Ans. \$6

10. What will 39 bushels of salt cost at $33\frac{1}{3}$ cents per bushel? Ans. 13

Op. $33\frac{1}{3}$ cts. $= \frac{1}{3} \times$ ~~39~~ | \$13.00 Ans.

11. What will $3\frac{1}{2}$ yards of Kentucky jeans cost, at $33\frac{1}{3}$ cents per yard? Ans \$1.11 $\frac{1}{3}$

12. What will 36 yards of sheeting cost at 25 cts. per yard? Ans. \$9

13. What will $12\frac{1}{2}$ yards gingham cost, at 25 cents per yard? Ans. \$3.12 $\frac{1}{2}$

14. What will 2400 lbs. of bacon cost at $16\frac{2}{3}$ cts. per lb? Ans. \$400

Op. $16\frac{2}{3}$ cts. $= \frac{1}{3} \times$ ~~2400~~ | \$400 Ans.

15. What will $26\frac{1}{4}$ lbs. coffee cost, at $16\frac{2}{3}$ cents per lb? Ans. \$4.37 $\frac{1}{2}$

16. What will $16\frac{2}{3}$ yards calico cost, at $12\frac{1}{2}$ cents per yard? Ans. \$2.08 $\frac{1}{3}$

17. What will 48 yards of bagging cost, at $12\frac{1}{2}$ cents per yard? Ans. \$6

18. J. G. Holms, bought of Goolsby & Davenport, 180 lbs. of sugar, at 10 cents, what will he have to pay? Ans. \$18

19. What will 14 yards of cloth cost, at 5 cents per yard? Ans. 70 cts.

20. What will 54 yards of tape cost at $3\frac{1}{3}$ cents per yard? Ans. \$1.8

21. What will $5\frac{9}{12}$ yards edging cost at $3\frac{1}{2}$ cents per yard ? Ans. $19\frac{1}{2}$ cts.

22. What will $5\frac{1}{4}$ yards of cassimere cost at $\$1\frac{1}{2}$ per yard ? Ans. $\$7$

23. What will 59 yards of cassimere cost, at $\$1\frac{1}{2}$ per yard ? Ans. $\$65$

24. What will $17\frac{3}{4}$ bushels of rye cost at $\$1\frac{1}{4}$ per bushel ? Ans. $\$22\frac{1}{2}$

25. What will 2 dozen knives cost at $\$1\frac{1}{2}$ per knife ? Ans. $\$40$

26. What will $3\frac{1}{2}$ yards drilling cost at $16\frac{3}{4}$ cents per yard ? Ans $58\frac{1}{2}$ cts.

27 Bought of G. F. Peterson, 25 negro blankets, at $\$1\frac{1}{5}$ apiece, how much did I have to pay him ? Ans. $\$30$

28. What will 48 pair of shoes cost, at $\$1\frac{1}{3}$ per pair ? Ans. $\$66$

29. Bought of Calloway & Clark, a bill of goods, consisting of sundries, viz: $16\frac{1}{2}$ lbs. of cheese, at 14 cents per lb. ; 24 yards of calico, at $16\frac{3}{4}$ cents per yard ; 8 pair of shoes, at $\$1\frac{1}{3}$ per pair ; and .24 lbs. of casting, at $6\frac{3}{4}$ cents per lb ; what is the amount of the bill ? Ans. $\$18.98\frac{1}{2}$

DEDUCTION.

DEDUCTION is *discount* without time, and is an allowance to compensate for present payment.

RULE.

On the right, place the principal and rate per cent. If mixed numbers or fractions occur, see caution, page 35, and Practice, page 67

EXAMPLES.

1. What deduction should be made on \$25 at 8 per cent ? Ans. \$2

OPERATION.	25
	8
	<div style="border-top: 1px solid black; margin-top: 2px;">\$2.00</div>

NOTE. Point off two, it being reckoned by the 100.

2. If I buy goods to the amount of \$560, on credit, and the merchant tells me he will deduct 12 per cent. for ready money, what will it be ?

Ans. \$67.20

3. Messrs. Craytons sell goods on credit to the amount of \$78.50, but for ready cash, they agree to deduct 20 per cent. how much is the discount ?

Ans. \$15.70

4. What is the discount of \$520, at 5 per cent ?

Ans. \$26

5. What is the discount on $\$37\frac{1}{2}$, at $3\frac{1}{2}$ per cent ?

Ans. \$1.25

6. What is the discount on $\$447\frac{3}{5}$, at $5\frac{5}{6}$ per cent ?

Ans. \$26.11

7. What is the discount of \$1200, at $16\frac{2}{3}$ per cent ?

Ans. \$200

8. What is the discount of \$360, at $4\frac{1}{2}$ per cent ?
 Aus. \$16
9. What will be deducted from \$48 at $12\frac{1}{2}$ per cent ?
 Aus. \$6
10. What will be deducted from $\$7\frac{1}{2}$ at $6\frac{1}{2}$ per cent ?
 Ans. 48 cents.

INSURANCE.

INSURANCE is an obligation to insure against loss or damage.

RULE.

Place the principal and rate per cent. on the right. Point off two.

If mixed numbers occur, see caution, page 35, or fractions, see Practice, page 67.

EXAMPLES.

1. What is the insurance of a house valued at \$2400, at $\frac{3}{4}$ per cent ?
 Aus. \$18

OPERATION. $\begin{array}{r|l} 2400 & \\ \hline 3 \times 6 = & \$18.00 \end{array}$ Aus.

2. What is the insurance of George F. Platt's store, valued at \$24,000, at $\frac{7}{8}$ per cent ?

Aus. \$210

3. What is the insurance on a gin-house and cotton valued at \$3600, at $\frac{3}{5}$ per cent ?
 Aus. \$21.60

4. What is the insurance of \$4800 of stock at $\frac{3}{8}$ per cent ?
 Aus. \$18

5. What is the insurance on a house in Athens, valued at \$12000, at $1\frac{1}{2}$ per cent ? Ans. \$180

6. What is the insurance of a powder-mill valued at \$3600, at $16\frac{2}{3}$ per cent ? Ans. \$600

7. What is the insurance of a foundry, valued at \$400 dollars, at $12\frac{1}{2}$ per cent ? Ans. \$800

8. What would be the insurance on \$2800, at $3\frac{1}{4}$ per cent ? Ans. \$91

9. William Williams had the life of his horse insured at $3\frac{1}{2}$ per cent. and valued him at \$240, what insurance did he pay ? Ans. \$8

10. James T. Johnson, of Lexington, Ga., takes an insurance on his house and furniture, valuing at \$4800, the per cent. being $2\frac{1}{2}$, what did he pay the insurance company ? Ans. \$120

11. Dr. William G. Ham, having purchased a house and furniture in the town of Lexington, Ga., for which he paid \$2400, what will it cost him to insure at $3\frac{1}{2}$ per cent ? Ans. \$80

12. A man owning a sixteenth of a ship, which cost him \$2750, got it insured at $7\frac{1}{2}$ per cent. how much did he pay ? Ans. \$206.25

13. George F. Platt, bought a package of goods in New York, valued at \$2700 ; he wishes to ship them to Charleston by water, and effects an insurance at $1\frac{1}{2}$ per cent. what did the insurance cost him ?

Ans. \$36

COMMISSION.

COMMISSION is the per centage paid to an *agent*, *factor* or *commission merchant*, for buying or selling goods, or transacting other similar business.

RULE.

Place the given sum or principal on the right, with the rate per cent. under it. Should fractions or mixed numbers occur, see caution, page 35, and Practice, page 67

EXAMPLES.

1. My agent in Augusta, has sold, for me, cotton to the amount of 876 dollars, what is his commission at $1\frac{1}{2}$ per cent ? Ans. \$15.33

OPERATION.
$$\begin{array}{r|l} 876 & \\ \hline 7 & 219 \times 7 = \$15.33 \end{array}$$

2. If I get an agent to buy me 12 shares in the Georgia Railroad, at $104\frac{1}{2}$ dollars per share, what will be his commission at $3\frac{1}{2}$ per cent ?

Answer, \$41.90

3. What is the commission on 1500 dollars at 2 per cent ? Answer, \$30

4. What is the commission on 850 dollars at $3\frac{1}{2}$ per cent ? Answer, \$29.75

5. What is the commission on 1700 dollars, at $2\frac{1}{2}$ per cent ? Answer, \$42.50

6. What is the commission on 1500 dollars, at $3\frac{1}{2}$ per cent ? Answer, \$50

7. What is the commission on 800 dollars, at $\frac{1}{2}$ per cent ? Answer, \$4

8. What is the commission on 2000 dollars, at $\frac{3}{4}$ per cent ? Ans. \$15

9. What is the commission on $180\frac{8}{9}$ dollars, at $6\frac{1}{2}$ per cent ? Answer, \$12.21

10. What is the commission on $889\frac{1}{2}$ dollars, at $2\frac{1}{2}$ per cent ? Answer, \$23.34

BROKERAGE.

BROKERAGE is percentage paid to a dealer in money and stocks, called a *broker*, for making exchanges of money, or transacting other like business.

RULE.

Place the principal and per cent. on the right. If fractions or mixed numbers occur, see caution, page 35, and Practice, page 67.

1. What is the brokerage on 24 dollars, at $\frac{1}{4}$ per cent ? Ans. 6 cts.

OPERATION. $\begin{array}{r|l} \$24 & \\ \hline 1 \times 6 = 6 & \text{cts. Ans.} \end{array}$

2. What is the brokerage on 350 dollars, at $\frac{1}{2}$ per cent ? Ans. \$1.75

3. What is the brokerage on 500 dollars, at $\frac{3}{4}$ per cent ? Ans. \$3.75

4. What is the brokerage on 1000 dollars, at $1\frac{1}{4}$ per cent ?
Ans. \$12.50

5. When a broker buys goods for me, amounting to \$1680.48, what amount of commission must he receive at $1\frac{1}{4}$ per cent ?
Ans. \$21

6. If my broker sends me 2400 dollars' worth of goods, what is his commission at $1\frac{3}{4}$ per cent ?
Ans. \$42

7 I sent my broker, in New York, a check amounting to \$4800.48, on its reception, he found he could not make the exchange for less than $2\frac{1}{4}$ per cent. what was the loss on the amount of the check ?
Answer, \$108.01

8. What is the brokerage on $24\frac{4}{5}$ dollars, at $\frac{3}{4}$ per cent ?
Answer, $18\frac{3}{5}$ cts.

9. What is the brokerage on $98\frac{3}{8}$ dollars, at $1\frac{1}{7}$ per cent ?
Ans. \$1.12 $\frac{3}{7}$

10. What is the brokerage on $66\frac{2}{3}$ dollars, at $1\frac{1}{4}$ per cent ?
Ans. $83\frac{1}{2}$ cts.

11. What is the brokerage on \$112 $\frac{4}{5}$, at $\frac{7}{6}$ per cent ?
Ans. \$1.31 $\frac{3}{5}$

12. I sent to my merchant, in Charleston, 40 bales of cotton weighing 400 lbs. each, which he sold at $12\frac{1}{2}$ cents per lb. I directed him to get the amount in gold ; what is the amount of brokerage, at $2\frac{1}{2}$ per cent ?
Ans. \$50

BARTER.

BARTER is the exchange of one commodity for another without loss to either party.

1 **PROP.** To find what quantity of anything, at a given price is equal in value to some other quantity whose price is given.

RULE.

Place the given quantity and its price, on the right, and the price of the desired quantity on the left.

EXAMPLES.

1. How many lbs. of sugar at 12 cts. a lb. must be given for 30 lbs. coffee, at 8 cents a lb?

Answer, 20 lbs.

OPERATION. $\begin{array}{r|l} 12 & 30 \\ \{ \begin{array}{l} 4 \\ 3 \end{array} & \begin{array}{l} 8 \\ 2 \times 10 = 20 \text{ lbs.} \end{array} \end{array}$

2. How many bushels wheat, at \$1.60 a bushel, are equal to 320 bushels corn, at 80 cents a bushel?

Ans. 160

3. What number of yards of muslin, at 40 cents a yard, is equal to 60 yards of jeans, at 80 cents a yard?

Ans. 120 yds.

4. How many yards calico, at $12\frac{1}{2}$ cts. are equal to 50 dozen eggs, at $8\frac{1}{2}$ cts. per dozen?

Ans. 34 yds

5. How many pounds butter, at 18 cents a pound, will pay for 54 pounds sugar at $12\frac{1}{2}$ cents a pound?

Ans. $37\frac{1}{2}$ lbs.

6. Bought 14 boxes raisins, each containing 24 pounds, at 9 cents a pound, and paid for it, 42 barrels of lime, at 12 cents per bushel; how many bushels in each barrel?

Ans. 6

7 I barter sugar at $9\frac{3}{8}$ cents per pound, for $18\frac{1}{4}$ lbs. tea, at 96 cents a pound, how many pounds sugar will it take?

Ans. 192 lbs.

8. D. Whelchel, Jr. "swaps" $12\frac{4}{5}$ bushels peas at $81\frac{1}{2}$ cents per bushel, for oats at $25\frac{3}{5}$ cents per bushel, how many bushels oats did he get?

Ans. $40\frac{5}{8}$

9. Gray & Co., have 500 bushels corn, at $62\frac{1}{2}$ cts. per bushel, which they barter with Nicholson & Reaves, for salt, at $\$2\frac{1}{2}$ per sack; how many sacks required?

Ans. 125

10. I send to Augusta, 900 dozen eggs, at $16\frac{2}{3}$ cts. per dozen, to buy salt, how many sacks will I get at $\$1.50$ per sack?

Ans. 100 sacks.

2 PROP. To find at what price a commodity has been disposed of when bartered for another whose price is given.

RULE.

Place the given quantity and its price on the right, and the quantity whose price you wish to ascertain, on the left.

EXAMPLES.

11. Gave 81 pounds butter for 18 pounds of to-

bacco, at 90 cts. a pound ; what was the butter per pound ?

Ans. 20 cts.

OPERATION. $\begin{array}{r|l} \$1 & 1\$ \\ \cancel{0} & \cancel{00} \\ \hline & 2 \times 10 = 20 \text{ Ans.} \end{array}$

12. A. C. Shockley " swaps " 20 bushels of wheat at \$1.50 per bushel, for 50 bushels of corn ; what did he allow for the corn per bushel ?

Ans. 60 cts.

13. Bought 48 pounds tobacco, at $62\frac{1}{2}$ cts. per pound, and gave 96 yards of cloth for it ; what did I get for my cloth, per yard ?

Ans. $31\frac{1}{2}$ cts.

14. A bookseller gives 400 dictionaries, worth $87\frac{1}{2}$ cents apiece ; for 700 grammars ; how much did the grammars cost apiece ?

Ans. 50 cts.

15. Bought 432 sheep, at $\$2\frac{1}{4}$ apiece, for which I paid 144 barrels of flour ; what was the flour per barrel ?

Ans. $\$6\frac{1}{4}$

16. Gave $748\frac{1}{2}$ yards of silk for $249\frac{1}{2}$ yards of broadcloth, at $\$5\frac{1}{4}$ per yard ; what was the silk a yard ?

Ans. $\$1\frac{1}{4}$

17. What will my wheat be per bushel, if I give $14\frac{2}{3}$ bushels to John H. Newton, for 176 yards of tweeds, at $18\frac{1}{4}$ cents per yard ?

Ans. \$2.25

18. M. H. Hall, sold 95 bushels wheat at \$1.30 per bushel, 50 bushels of oats, at 40 cts per bushel, 25 bushels rye, at 70 cts. per bushel, and got, in return, 55 barrels of corn, what did he allow per bushel for the corn ?

Ans. 60 cts.

19. Mrs. J. David, barterers 45 yards jeans for 16 yards calico, at 12 cents a yard, $19\frac{1}{2}$ yards linen, at

80 cents, 15 yards bleaching at 14 cents a yard, and 24 yards cambric, at 12 cents a yard, what was she allowed per yard for jeans? Ans. 50 cts.

20. A carriage maker buys 1200 spokes at $1\frac{1}{4}$ cts. apiece, 800 felloes at $2\frac{3}{4}$ cents apiece, and gives 800 lbs. iron, what does he get per lb. for his iron?

Ans. $4\frac{5}{8}$ cts.

EQUATION OF PAYMENTS.

EQUATION OF PAYMENTS is the process of finding the average time when two or more payments, due at different times, may be made *at once*, without loss to either party.

RULE.

Multiply each payment by the time at which it is due; then divide the sum of the products, by the sum of the payments, and the quotient will be the mean time.

EXAMPLES.

1. John owes James \$300, of which, \$50 is due in 2 months, \$100 in 5 months, and the balance in 8 months, what is the equated time?

Ans. 6 months.

$$\begin{array}{r} \text{Or. } \$ 50 \times 2 = 100 \\ 100 \times 5 = 500 \\ 150 \times 8 = 1200 \end{array}$$

$$\begin{array}{r|l} 2000 & 1800 \\ \hline & 6 \text{ Ans.} \end{array}$$

2. A merchant in Athens, has owing to him \$500, to be paid as follows : \$250 in 6 months, \$250 in 8 months ; but it is agreed that the whole shall be paid at one time, when must it be paid ?

Ans. 7 mos.

3. E. owes F \$550, of which \$100 is to be paid in 3 months, \$200 in 5 months, \$250 in 8 months, but has agreed to make one payment of the whole, when must it be paid ?

Ans. 6 mos.

PARTNERSHIP.

PARTNERSHIP is a union of two or more individuals, for the purpose of carrying on a joint business.

1 PROP. When each partner's stock is employed for the same length of time.

RULE.

Multiply each partner's stock by the whole gain or loss, and divide the product by the whole stock, and the quotient will be his gain or loss. Or, place the gain or loss with each partner's stock on the right of the vertical line, and the sum of their shares on the left.

EXAMPLES.

1. John, James and William, buy a horse for \$150, and sell him at a gain of \$30. John pays \$40, James \$50, and William \$60, what is each one's share of the gain ?

Op.	40	50	60	<hr style="width: 50px; margin: 0 auto;"/>	150	30	30	40	\$8 John's gain.

Ans.	}	John's \$8
		James' \$10
		Wm's. \$12

150	30	30	40	\$10 James' gain.

150	30	30	40	\$12 Wm's. gain.

2. Glenn & Tiller traded in co-partnership, Glenn contributed \$85.50, Tiller \$74.50. They lose 10 per cent. on their capital, what is each one's share of the loss?

Ans.	}	Glenn's \$8.55
		Tiller's \$7.45

3. Messrs. Goolsby & Davenport traded together. Goolsby put in 1600 dollars, Davenport 2400 dollars, they gained 800 dollars, what is each one's share of the gain?

Ans.	}	Goolsby's \$320
		Davenport's \$480

4. Messrs. Glenn & Tiller entered into partnership, with a capital of 3600 dollars. Glenn put in 1600 dollars, Tiller the remainder; they gained 25 per cent. on the capital invested, and Glenn received 240 dollars for his services, in proportion to each one's share of the stock invested, what is each one's share of the gain, and what is each one's share of the clerk's hire?

Ans.	}	Glenn's \$400
		Tiller's \$500
		Glenn's \$106½ cl'k. hire.
		Tiller's \$133½ " "

5. A merchant failing owes the following debts: to F 1200 dollars, to G. 1600 dollars, to H. 2000 dollars, his effects amount to 3000 dollars, what is the portion each receives?

$$\text{Ans. } \left\{ \begin{array}{l} \text{F. } \$750 \\ \text{G. } \$1000 \\ \text{H. } \$1250 \end{array} \right.$$

6. A. B. and C. entered into a joint speculation on a capital of 20,000 dollars, of which A. furnishes 5000 dollars, B. 7000 dollars, and C. the remainder. Their net profits were 5000 dollars; what was each one's share of the gain?

$$\text{Ans. } \left\{ \begin{array}{l} \text{A. } \$1250 \\ \text{B. } \$1750 \\ \text{C. } \$2000 \end{array} \right.$$

2 PROP. When each partner's stock is employed for different periods of time.

RULE.

Multiply each partner's stock by its time; then as the sum of these products is to each product, so is the whole gain or loss to each partner's share of the gain or loss.

EXAMPLES.

7 John put in 50 dollars for 4 months, William put in 60 dollars for 5 months; they gained 15 dollars, what is the share of each?

$$\text{Ans. } \left\{ \begin{array}{l} \text{John } \$6 \\ \text{Wm. } \$9 \end{array} \right.$$

$$\begin{array}{l} \text{Or. } \$50 \times 4 = 200 \\ \quad \$60 \times 5 = 300 \end{array}$$

$$\begin{array}{r|l} \cancel{500} & \cancel{200} \\ \cancel{100} & 100 \\ \cancel{500} & \cancel{300} \\ \cancel{100} & 100 \end{array} \quad \begin{array}{l} 3 \times 2 = \$6 \\ 3 \times 3 = \$9 \end{array}$$

8. A. commenced business on the 1st of January with a capital of 1200 dollars; on the 1st of April, he took in B. with a capital of 1600 dollars; on the 1st of September, he took in C. with a capital of 900 dollars. They gained by the end of the year 1080 dollars; what was each man's share of the gain?

Ans. $\left\{ \begin{array}{l} \text{A's. } \$480 \\ \text{B's. } \$480 \\ \text{C's. } \$120 \end{array} \right.$

BANKING.

A **BANK** is a joint stock company established by law, to receive deposits, lend money, or issue bank bills redeemable in specie at the place of business.

Bank discount is the simple interest paid in advance, and is counted for *three days* more than the given time, which three are called "days of grace."

To find the *bank discount*.

RULE.

Find the interest on the note or sum discounted for three days more than the given time, and you have the bank discount. If the present worth be required, subtract the discount from the note or sum.

EXAMPLES.

1. What is the bank discount on a note of \$1200, payable in 60 days, at $\frac{7}{100}$ per cent? Ans. \$14.70

For Operation, $\begin{array}{r|l} 12 & 1200 \\ \times 7 & 7 \end{array}$
 see Rule, page 49 $\begin{array}{l} 83 \text{ time with 3 days added.} \\ 21 \times 7 \times 100 = \$14.70 \end{array}$

2. What is the bank discount on a draft of 240 dollars, payable in 4 months, at 7 per cent ?

Ans. \$5.74

3. What is the bank discount on 5000 dollars due in 15 days, at 6 per cent ?

Ans. \$15

4. At 6 per cent. what is the bank discount of 180 dollars, for 4 months and 15 days ?

Ans. \$4.14

5. What is the bank discount on 60 dollars, payable in 1 month and 7 days, at 9 per cent ?

Ans. 60 cts.

6. What is the present worth of a note of 360 dollars, due 77 days hence, discounted at bank, at 5 per cent ?

Ans. \$356

7. What is the present worth of 720 dollars, due in 97 days, discounted at bank, at 8 per cent ?

Ans. \$704

8. What is the bank discount on 144 dollars, payable in 15 days, at 12 per cent ?

Ans. 86½ cts.

9. What is the present worth of a note of 15000 dollars, payable in 3 days, at 6 per cent. discount ?

Ans \$14,985

10. What is the bank discount on a draft of \$3600 payable in 21 days, at 6½ per cent ?

Ans. \$15 60

EVOLUTION.

EVOLUTION is the process of extracting the roots of quantities.

The *root* of any number is such a factor or number as multiplied by itself a certain number of times will produce that quantity or number.

The root takes the name of the power from which it is evolved. If a number is *second* power, its root is called the second or *square root*; if it is the *third* power, the root is called the *third* or *cube root*.

SQUARE ROOT.

THE EXTRACTION OF THE SQUARE ROOT of a number is the process of finding what root, squared or multiplied, by itself, will make that number.

RULE.

Separate the given number into as many periods as possible of two figures each, by beginning at the right, using a point between the periods at the top.

Find the root of the greatest square in the left hand period, and write it to the right of the given number, as you would a quotient in division, and subtract its square from the left hand period. Bring

down the next period to the right of the remainder for a dividend, and double the root already found for a trial divisor. Find how often this divisor is contained in the dividend, exclusive of one figure at the right, and write the quotient as the next figure of the root. Annex this last figure of the root to the right of the trial divisor for the true divisor, which multiply by the last root figure, and subtract the product from the dividend. To the remainder bring down the next period for a new dividend.

Double the root already found for a new trial divisor, and proceed as before, till all the periods have been brought down.

NOTE. If fractions occur, extract the square root of the numerator and the denominator separately

EXAMPLES.

1. What is the square root of 1225?

OPERATION. 1225(35 Ans. 35
 9

65	325
	325

DEMONSTRATION.—The *reasons* for the several steps in this rule, may be inferred from the preceding illustration.

1st. *Separating* the given number into *periods of two figures* each, shows how many figures the root is to contain, and thus enables us to find *part* of the root at a time.

2d. The *square* of the first figure of the root, shows the number of feet, yards, &c., disposed of by the first figure of the root; it is subtracted from the period to find how many *feet, yards, &c. remain* to be added.

3d. The root is *doubled* for a trial divisor, because the addition must be made on *two sides* of the square already found, or it will cease to be a *square*.

4th. In dividing, the *right hand figure* of the dividend is *omitted* because the cipher on the right of the divisor is *omitted*; otherwise the quotient would be 10 *times* too large for the next figure of the root. The last figure of the root is placed on the right of the divisor for convenience in multiplying. The divisor is then multiplied by the last figure of the root, to find the *area* of the *several additions* thus made,

2. What is the square root of 4225? Ans. 6

3. What is the square root of 6056521?

Ans. 2461

4. What is the square root of 53824?

Ans. 232

5. What is the square root of 12321? Ans. 111

6. What is the square root of 22420225?

Ans. 4735

7. What is the square root of $\frac{256}{1296}$? Ans. $\frac{4}{3}$

8. What is the value of $\sqrt{\frac{4900}{48656}}$? Ans. $\frac{8}{27}$

9. What is the square root of $\frac{4}{9}$ of $\frac{16}{25}$ of $\frac{49}{81}$ of 144? Ans. $4\frac{4}{5}$

10. What is the square root of 998001?

Answer, 999

APPLICATION OF THE SQUARE ROOT

A *circle* is a figure bounded by a line equally distant from the centre.

A *triangle* is a figure of three sides.

An *equilateral triangle* is a figure whose three sides are all equal.

A *scalene triangle* is one which has its three sides unequal.

A *right-angled triangle* is one with one right angle.

The *hypotenuse* is the longest side in a right-

angled triangle, the horizontal side is the *base*, and the other, the *perpendicular*.

1 PROP. To find the *hypotenuse*.

RULE.

Square the base and perpendicular, add the squares together, and extract the square root of the sum.

EXAMPLES.

1. What will be the hypotenuse, if the base be 40 ft. and the perpendicular 30 ft? Ans. 50 ft.

OPERATION.

40 squared=1600; 30 squared=900, $1600+900=2500$;
 $\sqrt{2500}=50$ Ans.

2. What is the length of the hypotenuse with a base 80 feet, and perpendicular 18 feet?

Ans. 82 ft.

3. A tree known to be 90 feet high, stands on the bank of a river 120 feet wide; what is the distance from the top of the tree to the opposite side of the river?

Ans. 150 ft.

4. A tree 45 feet high stands in the centre of a circular island 98 feet in diameter, what will be the length of a line to reach from the top of the tree to the edge of the water?

Ans. 66+ft.

5. What is the length of a ladder which will just reach to the top of a house 32 feet high, when its foot is placed 24 feet from the house?

Ans. 40 ft.

6. The height of a precipice near the side of a river, is 77 feet, the river being 36 feet wide, required

the distance from the top of the precipice to the opposite bank of the river. Ans. 85 ft

7 Two men start from the same point at the same time ; one goes exactly south, 40 miles a day, the other goes exactly west, 30 miles a day ; how far apart will they be at the end of 4 days ?

Ans. 200 miles

2 PROP. To find the *base*.

Square the hypotenuse and perpendicular, take their difference and extract the square root.

EXAMPLES.

8. The hypotenuse is 25 chains and the perpendicular 15 chains ; required the base ?

Ans. 20 chains.

OPERATION.

25 squared = 625; 15 squared = 225. $625 - 225 = 400$.

$\sqrt{400} = 20$.

20 Ans.

9. A certain castle, 45 feet high, is surrounded by a ditch, to the far edge of which, a line 75 feet long will just reach from the top of the castle ; what is the width of the ditch ?

Ans. 60 ft.

10. A ladder, 41 feet long, is so planted as to reach a window 9 feet from the ground ; how far is the bottom of the ladder from the sill of the house ?

Ans. 40 ft.

11. On the side of a street, stands a tower 96 feet high, from the top of which, a line 100 feet long, reaches to the opposite side of the street—required, the width of the street ?

Ans. 28 ft.

12. The hypotenuse is 109 feet, and the perpendicular is 60 feet; required, the base? Ans. 91 ft.

13. In the centre of a circular island, stands a pole 14 feet high, from the top of which, a line 50 feet long, will just reach to the edge of the water; what is the diameter of the island? Ans. 96 ft.

14. A ladder 70 feet long, is planted so as to reach a window 40 feet from the ground, on one side of the street, and without moving it at the foot, it will reach a window 30 feet high on the other side; what is the breadth of the street? Ans. 120+ft.

3 PROP. To find the *perpendicular*.

RULE.

From the square of the hypotenuse, subtract the square of the base, and extract the square root.

15. The hypotenuse is 26, the base 24; what is the perpendicular? Ans. 10

OPERATION.

$$26 \text{ squared} = 676; 24 \text{ squared} = 576$$

$$\text{Then } 676 - 576 = 100. \quad \sqrt{100} = 10$$

16. Upon the side of a street 28 feet wide, stands a house. If a line 100 feet long, will reach from the far side of the street to the top of the house, what is the height of the house? Ans. 96 ft.

17. The base is 15 feet, the hypotenuse 17 feet; what is the perpendicular? Ans. 8 ft.

18. From the top of a tree a line, 125 feet long, just reaches to the opposite bank of a river 75 feet wide; what is the height of the tree?

Ans. 100 ft.

19. A line drawn from the top of the steeple of a certain meeting-house, to a point at the distance of 50 feet, on a level from the base of the steeple, is 120 feet in length; what is the height of the steeple?

Ans. 109+ft.

20. Two ships start from the same port at the same time; one travels east, at the rate of 40 miles per hour, while the other travels south; at the end of 4 hours they are 200 miles apart, how far did the slower ship travel?

Ans. 120 miles.

4 PROP. To find the *diagonal* of a cube.

RULE.

Square the 3 sides, add their squares together, and extract the square root of the sum.

EXAMPLES.

21. What is the diagonal of a cube 24 inches every way?

Ans. 41+inches.

$$\text{OP. 24 sqrd.} = 576 + 576 + 576 = 1728$$

$$\text{and } \sqrt{1728} = 41 + \text{inches.}$$

22. A certain school-room is 20 feet long, 16 feet wide, 12 feet high; how long must a line be to extend from one of the lower corners to an opposite upper corner?

Ans. 28+ ft.

23. If a church is 40 feet long, 30 feet wide, and 14 feet between the floors, what is the length of a diagonal drawn on the floor, and what is the length of a diagonal drawn from the floor to the ceiling?

Ans. $\left. \begin{array}{l} 50 \text{ ft.} \\ 51.9 \text{ ft.} \end{array} \right\}$

24. A room is 18 feet 6 inches long, 12 feet 4 inches wide, and 10 feet 3 inches high ; what is the distance diagonally, from an upper to a lower corner ?

Ans. 24+ft.

25. A box being $3\frac{1}{4}$ feet deep, $5\frac{1}{5}$ feet long, $4\frac{1}{2}$ feet wide ; what is the diagonal line drawn from the bottom of the box to the opposite upper corner ?

Ans. 7 feet+

5 PROP. To find the *side* of a *square* equal in area to any *given surface*.

RULE.

Extract the square root of the given surface or area, and the result will be the side of the square sought.

EXAMPLES.

26. What is the length of the side of a square containing 1024 feet ?

Ans. 32 ft.

OP. $\sqrt{1024}=32$ feet.

27 What is the side of a square equal in area to a rectangle 81 rods long and 49 rods wide ?

Ans. 63 rods.

28. I have a piece of land 80 rods by 20 rods, and want to exchange it for a square piece of the same area, what will be the length of one side ?

Ans. 40 rods.

29. A farmer has a rectangular field 200 rods one way, and 18 rods the other, how long would one side of a square be to contain the same area ?

Ans. 60 rods.

30. What is the side, in rods, of a square equal in area to a circular field which contains 640 acres?

Ans. 320 rods.

31. What is the side, in rods, of a square equal in area to a triangular field, which contains 160 acres?

Ans. 160 rods.

APPLIED TO CIRCLES.

6 PROP. Circles are to each other as the squares of their diameters or circumferences.

If the diameter of a circle be multiplied by 3.1416 or $3\frac{1}{7}$, the product will be the circumference.

If the square of the diameter of a circle be multiplied by .7854 or $\frac{11}{14}$, the product will be its area.

EXAMPLES.

1. If, for \$3.60, I buy a circle of land, whose diameter is 40 yards, what would be the diameter of a circle, that I could buy for \$14.40? Ans. 80 yds.

OR. *as in Proportion.*

~~3.60~~ | ~~14.40~~ We place 40 on the right twice, to square
40 it. Then $\sqrt{6400}=80$ Ans.
40
 $4 \times 40 \times 40 = 6400$

2. If a circular plate of sheet iron, 16 inches in diameter, weigh 8 lbs. what must be the diameter of a plate, of the same iron, to weigh 24 lbs?

Ans. 27+ inches.

3. If a circular piece of land, 30 rods in diameter, cost \$7.60, what would another circle of the same land cost, 45 rods in diameter? Ans. \$17 10

4. If a grindstone 12 inches in diameter weigh 24 lbs. what would be the weight of one of the same thickness, 16 inches in diameter?

Ans. $42\frac{2}{3}$ lbs.

5. If a circle of 21 inches in diameter, contain 231 square inches, what would be the diameter of a circle containing 924 square inches?

Answer, 42 in.

6. If a circle of land, 210 yards in circumference, be worth \$45, what would a circle, 420 yards in circumference be worth?

Answer, \$180

7 What must be the length of a rope, in yards, that, tied to a horse's neck, would allow him to feed over an acre of ground?

Answer, $39\frac{1}{2}$ yds.

$$\begin{array}{r} \text{Op. } 11 \mid 70 \\ 70 \end{array}$$

$$14 \times 70 \times 70 \div 11 = 6236 \times$$

Then $\sqrt{6236} = 79\frac{1}{2}$, and $79 \div 2 = 39\frac{1}{2}$ Ans.

The horse will feed over a circle whose area is one acre, or 70×70 yards, (which we will work with, though not strictly accurate) and as the area of a circle is obtained by squaring its diameter and multiplying by $\frac{11}{14}$, so dividing the area of any circle by $\frac{11}{14}$ and extracting the square root of the quotient will give the diameter.

The rope, in the above question, being fastened to something in the centre of the circle, it is only half the diameter—hence we divide by 2.

8. We have a circular meadow, whose area is 1386 square yards, how long will a rope be, in yards, to allow a horse to feed over it?

Answer, 21 yds.

9. I have a circular meadow containing 2464 square yards, how long must a rope be, in yards, to allow a mule to eat grass all over the meadow?

Answer, 28 yds.

10. Three men bought a grindstone 32 inches in diameter, A. paying 70 cts. B. 50 cts. C. 40 cts. They agree that A. shall grind off his share first, then B. and then C. How much will each grind off?

Ans. A. 4 in. B. 4 in. C. 8 in.

OPERATION.

The semi-diameter of the grindstone is 16 inches, which, squared=256. A paid $\frac{7}{16}$ of the money—then $\frac{7}{16}$ of 256=112, which taken from 256, will leave B. and C's, portion, or the semi-diameter for them. $256-112=144$, and $\sqrt{144}=12$, the semi-diameter for B. and C. $16-12=4$ inches, A's portion. B. paid $\frac{5}{16}$ of the money—then $\frac{5}{16}$ of 256=80, which taken from 144, B. and C's. portion, will leave C's. $144-80=64$ and $\sqrt{64}=8$ in. C's. portion, and $12-8=4$ in. B's. portion.

NOTE. Those who prefer, can consider the grindstone a circle, and work by getting the *area* of the circle, &c.

11. Peter, Andrew and James buy a grindstone 64 inches in diameter, for \$3.20, of which A. pays \$1.40, B. \$1.00, and C. the rest; how far down the radius must each grind to get his share?

Ans. $\left\{ \begin{array}{l} \text{Peter 8 in.} \\ \text{Andrew 8 in.} \\ \text{James 16 in.} \end{array} \right.$

12. Three boys bought, at auction, a grindstone 16 inches in diameter. A. paying 7 cts. B. 5 cts. and C. 4 cts. ; what must each grind off to get his portion ?

Ans. $\left\{ \begin{array}{l} \text{A. 2 in.} \\ \text{B. 2 in.} \\ \text{C. 4 in.} \end{array} \right.$

CUBE ROOT.

EXTRACTING THE CUBE ROOT is the process of finding what number or root raised to the *third power*, will produce the given number.

RULE.

The given number must be separated into periods of three figures, each beginning at the right hand figure.

Find the root of the greatest cube in the left hand period and place it to the right of the given number as the first figure of the required root. Subtract its cube from the left hand period, and to the remainder bring down the next period for a dividend.

Multiply the square of the root already found by 3, and to the product annex 2 ciphers for a trial divisor. See how often it is contained in the dividend, and place the result as the next figure of the root. Multiply the figures of the root previously found, by this last figure, with a cipher annexed, then multiply this product by 3, and place the result

under the trial divisor ; under this, place the square of the last figure placed in the root, and add the several results to the trial divisor and you have the true divisor.

Multiply the true divisor by the last figure placed in the root, and subtract its product from the dividend. To the remainder, bring down the next period for a new dividend, and proceed as before.

NOTE. If fractions occur, extract the cube root of the numerator and denominator separately.

EXAMPLES.

1. What is the cube root of 15625? Ans. 25.

OPERATION.

	15625	25
	8	
	<hr/>	
Trial divisor, 1200	7625	
300	7625	
25		
<hr/>		
True divisor, 1525		

EXPLANATION OF THE RULE. The reason for separating the given number into *periods of three figures*, is, that the *cube* of a number can not have *more* figures than *three times* the number of figures in the root, nor but *two less*. It also shows how many figures the *root* will contain, and thus enables us to find part of it at a time.

The reason we *square* the part of the root already found, is to find the *area* of one side of the remaining cube. We multiply its square by 3, because the additions are to be made to *three* of its sides. The reason we annex 2 ciphers to the trial divisor, is, that the first figure of the root stands in ten's place, since the next figure of the root is to be annexed or placed to the right of it. Then dividing the dividend by this result shows the thickness of the additions to be made to the three sides.

The reason we *multiply* the root already found, by the *last figure* placed in it, is, to find the area of a side of one of those additions to be made to the cube, and then multiplying this area by 3, we find the

area of a side of each of the three. The cipher is annexed to the *last figure* in multiplying by it, because that figure stands in ten's place with relation to the next figure of the root.

The object of *squaring the last figure* placed in the root, is, to find the area of a side of this cubical vacancy. We then have the *area* of one side of each of the *side additions*, the *area* of one side of each of the *corner additions*, and the *area* of one side of the *cubical vacancy*. These *areas* are added together, and their sum multiplied by the last figure placed in the root, for the purpose of finding the *solidity* of *all the additions, at once*. Of course, the result would be the same, if we multiply them separately, and then subtract the sum of their products from the dividend.

NOTE. *We are indebted to Thompson's Arithmetic, for a portion of the above explanation.*

2. What is the cube root of 12812904? Ans. 234
3. What is the cube root of 3796416? Ans. 156
4. What is the cube root of 529475129? Ans. 809
5. What is the cube root of 100544625? Ans. 465
6. What is the cube root of 87528384? Ans. 444
7. What is the cube root of 10648? Ans. 22
8. What is the cube root of $\frac{216}{343}$? Ans. $\frac{6}{7}$
9. What is the cube root of $\frac{729}{4096}$? Ans. $\frac{9}{16}$ +
10. What is the cube root of $27\frac{1}{27}$? Ans. $3\frac{1}{3}$

APPLICATION OF THE CUBE ROOT

Spheres are in proportion to each other, as the cubes of their diameters. If the cube of the diameter of a sphere be multiplied by the decimal .5236, or by the vulgar fraction, $\frac{1}{2} \frac{1}{1}$, the product will be the solidity.

Cubes, and all solid bodies, whose corresponding parts are similar and proportional to each other, are to each other, as the cubes of their diameters, or of their proportional sides.

EXAMPLES.

1. If a ball of lead, 4 inches in diameter, weighs 20 lbs. what will be the weight of one 8 inches in diameter? Ans. 160 lbs.

OPERATION.

We state as in Proportion. $4 \mid 20 \times 2 \times 2 + 2 = 160$ Ans
 Say as 4 cubed is to 20 lbs. $4 \mid \$2$
 so is 8 cubed to answer. $4 \mid \$2$
 $\$2$

2. If a ball of lead, 2 inches in diameter, be worth 2 dollars, what will one 6 inches in diameter be worth? Ans. \$54

3. If a ball of gold, $3\frac{1}{2}$ inches in diameter, be worth \$5145, what will be the diameter of a ball of gold worth \$120? Ans. 1 in.

4. If a ball, 3 inches in diameter, weighs 4 lbs. what will be the diameter of one weighing 32 lbs? Ans. 6 in.

5. If a man, 6 feet high, weighs 180 lbs. what was the weight of Gajah of Gath, who was $10\frac{1}{2}$ feet high? Ans. 964+ lbs.

6. If an ox, whose girth is 6 feet, weighs 600 lbs what is the weight of an ox, whose girth is 12 feet? Ans. 4800 lbs.

- 7 An ox, whose girth is 8 feet, weighs 800 lbs. what would be the girth of one weighing 6400? Ans. 16 ft.

8. A man has two similar stacks of hay, one 5 feet, and the other 20 feet in height. The smaller one weighs 50 lbs. what does the other weigh? Ans. 3200 lbs.

9. How many small balls, 2 inches in diameter, can be run out of one 8 inches in diameter?

Ans. 64

10. I have a ball of lead, 4 inches in diameter, which I wish to run up into balls $\frac{1}{2}$ inch in diameter, how many will I have?

Ans. 512

MENSURATION.

MENSURATION is the process by which the *areas* of *surfaces*, and the *solidity* of *solids* are found.

A *surface* is that which has length and breadth without thickness.

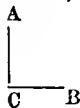
A *solid* is a body having length, breadth and thickness.

The *area* of a surface is its quantity of surface, expressed in square inches, square feet, yards, rods, &c.

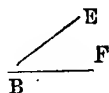
The *solidity* of a solid body is its *volume* expressed in cubic inches, cubic feet, &c.

An *angle* is the inclination or opening of two lines, which meet at a point.

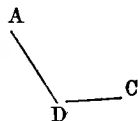
A *right-angle* is one formed by a base or straight line, and a perpendicular to it, as in the accompanying figure.



An *acute angle* is one less than a right-angle ; as the angle $E B F$



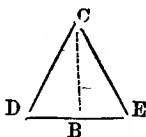
An *obtuse angle* is one greater than the right angle ; as the angle $A D C$.



Three-sided figures are called *triangles* ; those of four sides, *quadrilaterals*.

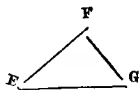
TRIANGLES.

An *equilateral triangle* is one whose sides are all equal ; as $D C E$.

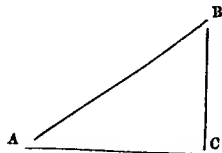


NOTE. The line $C B$, is the altitude of the triangle $D C E$.

A *scalene triangle* is one whose three sides are unequal , as $E F G$.



A *right-angled triangle* is one which has a right angle ; as $A C B$.



NOTE. In this triangle $A B$ is the *hypotenuse*, $A C$, the *base* and $C B$, the *perpendicular*

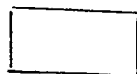
QUADRILATERALS.

A *parallelogram* is any quadrilateral whose opposite sides are parallel.

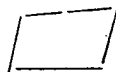
A *square* is a parallelogram whose sides are equal, and whose angles are right-angles.



A *rectangle* is any right-angled parallelogram.



A *rhomboid* is a parallelogram whose opposite sides are equal and parallel, and whose angles are not right-angles.



A *trapezoid* is a quadrilateral, which has two of its sides parallel.

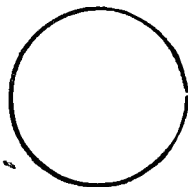


A *trapezium* is a quadrilateral, which has no two sides parallel.



CIRCLES.

A *circle* is the space bounded by a curve line, every part of which is equally distant from a point within, called the centre.



The *circumference* of a circle is the curve line which bounds it.

The *diameter* of a circle is a straight line passing through its centre, terminating at the circumference.

The *radius* is the distance from the centre to the circumference.

LAND MEASURE.

1 PROP. To find the area of a square tract of land or parallelogram.

RULE.

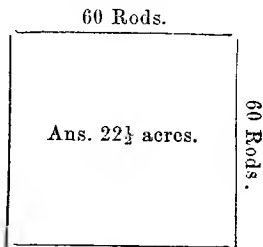
To the right of the vertical line, place the length and breadth; to the left, the standard for acres. Or, multiply the length and breadth together.

4. How many acres in a piece of land 60 rods square ?

OPERATION.

$$\begin{array}{r|l} 40 & 60 \\ 4 & 60 \end{array}$$

$$15 \times 6 = 90 \div 4 = 22\frac{1}{2} \text{ acres.}$$



2. What is the area of a field 80 rods on one side, and 40 on the other ?

Ans. 20 acres.

3. what is the area of a field 160 rods on one side, and 40 rods on the other ?

Ans. 40 acres.

4. What is the area of a field 80 rods on one side, and 4 on the other ?

Ans. 2 acres.

5. What is the area of a field 320 rods one side, and 80 on the other ?

Ans. 160 acres.

6. What is the area of a tract of land 320 rods on one side, and 160 rods on the other?

Ans. 320 acres.

7. What is the area of a tract of land 320 rods square?

Ans. 640 acres.

8. How many acres in a field 40 chains square?

Ans. 160 acres.

9. How many acres in a field 50 chains on one side, and 20 on the other?

Ans. 100 acres.

10. How many acres in a tract of land 150 chains on one side, and 10 on the other?

Ans. 150 acres.

2 PROP. *The area being given, to find the length of one side.*

RULE.

Extract the square root of area.

11. What is the side of a field, in chains, which contains 160 acres?

Ans. 40 chains.

OP. 160 acres.

10 chs.

$$\sqrt{1600}=40 \text{ chains.}$$

12. What is the side of a field, in chains, that contains 640 acres?

Ans. 80 chains.

13. What is the side of a field, in rods, that contains 160 acres?

Ans. 80 rods.

14. What is the side of a field, in rods, than contains 40 acres?

Ans. 80 rods.

3 PROP. *The diagonal of a square being given, to find area.*

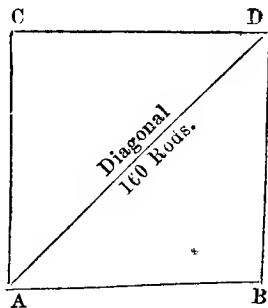
RULE.

Place the diagonal twice on the right, the standard and 2 on the left.

15. How many acres are contained in a field whose diagonal is 160 rods? Ans. 80 acres.

OPERATION.

$$\begin{array}{r|l} 160 & 160 \\ 2 & 160 \\ \hline \text{Ans.} & 80 \text{ acres.} \end{array}$$



16. How many acres are contained in a field whose diagonal is 40 chains? Ans. 80 acres.

17. How many acres are contained in a tract of land whose diagonal is 320 rods? Ans. 320 acres.

4 PROP. *The area of a square being given, to find the diagonal.*

RULE.

Extract the square root of double the area.

18. What is the diagonal, in chains, of a square tract of land whose area is 80 acres?

Ans. 40 chains.

OPERATION.

$$80 \times 2 = 160. \quad 160 \div 2 = 80. \quad 80 \div 2 = 40 \text{ chains.}$$

19. What is the diagonal, in rods, of a square whose area is 80 acres? Ans. 160 rods.

5 PROP. *Having one side and the area given, to find the other side.*

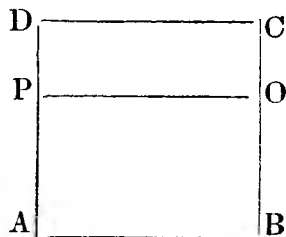
RULE.

Place the given area and standard on the right, and given side on the left.

NOTE. The standard is placed on the right with the given area, to reduce it to the same denomination as the given side.

20. What length must be cut off from the square A B C D, whose sides are 30 chains, to have the area A B O P 45 acres at the end?

OPERATION. $\left| \begin{array}{l} 45 \text{ acres.} \\ 30 \text{ } 10 \text{ chs.} \\ 15 \text{ Ans} \end{array} \right.$



21. What length must be cut off from a square field whose sides are 150 perches, to have an area of 50 acres? Ans. $53\frac{1}{2}$

22. A gentleman owns a tract of land, and wishes to cut off, for his daughter, 160 acres in the north-east corner of his land; should he run the line 320 rods west, how far south should he run to enclose the 160 acres? Ans. 80 rods.

6 PROP. The length and breadth of a rectangle being given, to find the area.

RULE.

Place the length and breadth on the right, and the standard on the left. Or, multiply the length and breadth together.

23. How many acres are contained in a rectangular field, whose sides are 80 rods and 40 rods?

$$\begin{array}{r|l} \text{Or. } 80 & 80 \\ 40 & 40 \\ \hline & 20 \text{ Ans.} \end{array}$$

24. The longest side of a garden is 24 rods, and the shortest 16, required the number of acres?

Ans. $2\frac{2}{5}$ acres.

25. How many acres are contained in a field whose sides are 36, and 18 chains? Ans. $64\frac{4}{5}$ acres.

26. A rectangular county is 40 miles long, and 30 miles wide; how many square miles in the county?

Ans. 1200 miles.

27. How many acres in a rectangular tract of land 160 chains on one side, and 40 on the other?

Ans. 640 acres.

7 PROP. To find the area of a rhombus or rhomboid.

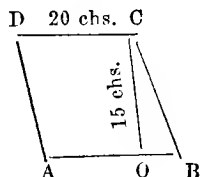
RULE.

Multiply the base by the altitude.

28. What is the area of a rhombus whose length is 20 chains, and height 15 chains?

Ans. 30 acres.

$$\text{OP. } \begin{array}{l|l} 1\phi & 2\phi \\ & 15 \times 2 = 30 \text{ Ans} \end{array}$$



29. How many acres are contained in a rhomboid, whose length is 240 perches, and width 60 perches?

Ans. 90 acres.

8 PROP. To find the *area* of a trapezoid.

RULE.

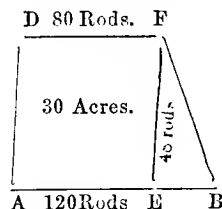
Multiply half the sum of the parallel sides by the altitude, and the product is the area.

30. I have a meadow in the shape of a trapezoid, whose parallel sides are 80 and 120 rods; the distance across the meadow is 48 rods, what is the area?

Ans. 30 acres.

OPERATION.
 $80 + 120 = 200$

$$\begin{array}{l|l} 2\phi & 2\phi\phi \\ 1\phi & 4\phi \\ 1\phi & 3 \times 10 = 30 \text{ Ans.} \end{array}$$



31. What is the area of a trapezoid, whose parallel sides are 80 and 140 rods, and the perpendicular distance 40 rods?

Ans. $27\frac{1}{2}$ acres.

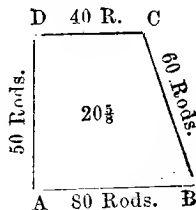
32. What is the area of a trapezium, whose opposite sides are 40, and 80 rods, the other two opposite sides 50 and 60 rods?

Ans. $20\frac{5}{8}$ acres.

OPERATION.

	40	50
	80	60
	—	—
2	120	110
2	110	
40		
4		

$$3 \times 110 = 330 \div 16 = 20\frac{5}{8} \text{ Ans.}$$



33. What is the area of a trapezium whose opposite sides are 120 rods, and 60 rods, the other two sides 55 and 25 rods? Ans. $22\frac{1}{2}$ acres.

TRIANGLES.

To find the area of any triangle, the base and altitude being given.

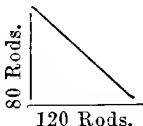
RULE.

Multiply the base by half the altitude. Or, place the dimensions on the right, and on the left 2, and the standard.

34. What is the area of a triangle whose base is 120 rods, and altitude 80 rods?

OPERATION.

	80	
2	160	
A	30	Ans.



35. What is the area of a triangle whose base is 40 chains, and altitude 20 chains?

Ans. 80 acres.

36. In a piece of land in a triangular shape, the base is 90 rods, the altitude 36 rods; what is the area? Ans. $10\frac{1}{2}$ acres.

37 The triangular gable of a certain house, has a base of 40 feet, and an altitude of 15 feet; how many square feet of plank will cover it?

Ans. 300 ft.

38. A piece of land in triangular shape, has a base 90 rods, altitude 67 rods; what does it contain?

Ans. 18 acres, 135 rds.

39. The end plate of a house is 24 feet long, and the altitude of the rafters is 9 feet; how many square feet in both gable ends?

Ans. 216 ft.

40. If the altitude of a triangle is $2\frac{1}{2}$ inches, and the base $8\frac{3}{5}$, what is the area?

Ans. 9 in.

CIRCLES.

1 PROP. To find the *circumference* of a circle, having the diameter.

RULE.

Multiply the diameter by 3.1416, or by $3\frac{1}{7}$, (which is equal to multiplying by 22 and dividing by 7)

1. What is the circumference of a circle 42 inches in diameter?

Ans. 132 in.

$$\text{OP. } \begin{array}{l} \cancel{42} \\ 22 \times 6 = 132 \text{ inches.} \end{array}$$

2. What is the circumference of a circular field 210 rods in diameter?

Ans. 660 rods.

3. If a circular fish-pond be 630 yards in diameter, how many feet round?

Ans. 5940 ft.

4. What is the circumference of a circle whose diameter is 12 feet and 3 inches?

Ans. $38\frac{1}{2}$ ft.

5. If I shoot a duck, directly on the opposite side of a circular lake 70 yards in diameter, how far will I have to walk to get it? Ans. 110 yds.

2 PROP. To find the *diameter*, having the circumference.

RULE.

Divide the circumference by 3.1416, or $3\frac{1}{7}$, ($\frac{22}{7}$)

1. If the circumference be 440 inches, what is the diameter? Ans. 140 in.

$$\text{OP. } \cancel{22} \mid \cancel{440} \\ 7 \times 20 = 140 \text{ inches.}$$

NOTE. We prefer working with $3\frac{1}{7}$.

2. What is the diameter of a tract of land 880 rods in circumference? Ans. 280 rds.

3. If I own a circular tract of land, 1 mile in circumference, what is the diameter in yards? Ans. 560

4. The circumference of a circle is $1\frac{4}{7}$ yards, what is the diameter in feet? Ans. $1\frac{1}{2}$ ft.

5. The circumference is $9\frac{3}{7}$, what is the diameter? Ans. 3

3 PROP. To find the *area* of a circle, having the diameter.

RULE.

Square the diameter, and multiply the square by .7854. Or, place the diameter on the right twice, with 11, and on the left, 14, or its factors.

NOTE. $\frac{1}{4}$ is not precisely the same as .7854, but near enough for practical purposes.

6. The diameter of a circle is 28 inches, what is the area? Ans. 616 in.

$$\begin{array}{r|l} \text{OP.} & 28 \\ 14 & 28 \\ & 11 \times 28 \times 2 = 616 \text{ Ans.} \end{array}$$

7 If a circular tract of land is 140 rods in diameter, what is the area in acres? Ans. 96½ acres.

8. How many acres in a circle 80 rods in diameter? Ans. 31¾ acres.

9. A farmer has a circular meadow 120 rods in diameter, how many acres in it? Ans. 70¾ acres.

10. How many acres in a circular island, whose diameter is 160 rods? Ans. 125⅝ acres.

11. How many acres in a circle of land 2 miles in diameter? Ans. 2011¾ acres

12. How many square inches in a circle 1 foot in diameter? Ans. 113⅙

4 PROP Having the diameters of two circles given, to find the *difference of areas*.

RULE.

Place the sum and difference of their diameters on the right, with 11; and on the left, place 14 or its factors.

13. I have two circular gardens, one 14 rods in diameter, and the other 28, and wish to know how much more in the greater than in the smaller.

Ans. 462 sq. rds.

OPERATION.

 $28 + 14 = 42$, and $28 - 14 = 14$. $\begin{array}{r|l} 14 & 42 \end{array}$
We place 42 and 14 on the right. $\begin{array}{r|l} 14 & \end{array}$ $11 \times 42 = 462$ Ans.

NOTE. By adding the two diameters together three circles are formed, 1st, 14, 2d, 28 and 3d, 42, and taking the difference, shows the number of parts that the second circle is of the *area* of the third.

14. A man owning two circular tracts of land, one 280 rods in diameter, and the other 840, desires to know the difference in acres. Ans. 3080 acres.

15. Of two circles, the greater is $10\frac{1}{2}$ inches, and the smaller is $3\frac{1}{2}$ inches; what is the difference of areas? Ans. 77 sq. in.

16. A well was dug 40 feet deep, 7 feet in diameter, and was to be walled up from bottom to top so as to leave the diameter within the stones $3\frac{1}{2}$ feet; how many solid feet of stone will it take?

Ans. 1155 ft.

NOTE. In such questions put the depth of the well, or the depth to be walled, on the right, and work as above.

17 A well 6 feet deep, and 6 inches in diameter, is to be walled, leaving the diameter within the wall 3 feet 6 inches; the wall to be 42 feet; how many solid feet of rock will be required? Ans. 990 ft.

5 PROP. To find the side of the greatest square that can be inscribed in a circle of a given diameter.

RULE.

Divide the square of the given diameter by 2, and

extract the square root, or multiply the diameter by .7071.

18. The diameter of a round table is 4 feet; what is the side of the greatest square table which can be made from it? Ans. 33.9 in.

19. I have a piece of round timber 50 inches in diameter, how large a square sill can be hewn from it? Ans. 35.3 in.

20. How large a square garden can be formed within a circular one, 50 yards in diameter? Ans. 35.3 yds.

6 PROP. To find the side of the largest equilateral triangle that can be inscribed in a circle of a given diameter.

RULE.

Multiply the diameter by 433, and divide by 500. Or, multiply by 866, and point off three figures from the right.

21. What will be the side of the largest equilateral triangle that can be inscribed in a circle of 20 inches in diameter? Ans. 17.3 in.

22. What is the length of one side of the greatest equilateral triangle that can be formed in a circle 74 rods in diameter? Ans. 64+rds.

23. If we lay off an equilateral triangle in a circle one foot in diameter, what will be the length of each side? Ans. 10.392 in.

24. We have a circle $1\frac{201}{1299}$ inches in diameter, and wish to inscribe an equilateral triangle, what will be the length of the side? Ans. 1 in.

25. If, in a circle $8\frac{7}{8}$ rods in diameter, we inscribe an equilateral, what is the length of each side?

Ans. $7\frac{1}{2}$ rds.

SPHERES.

A *sphere* is a solid, bounded by a curved surface, every part of which is equally distant from a point within, called a centre.

The diameter of a sphere is a line passing through the centre, terminating at the surface.

1. PROP. To find the *surface* of a sphere.

RULE.

Multiply the diameter by the circumference. Or, place the diameter twice, on the right, with 22, and on the left 7

1. Required the convex surface of a globe, whose diameter is 28 inches? Ans. 2464 sq. in.

NORE. Multiply the diameter by $3\frac{1}{7}$ to get the circumference.

2. What is the convex surface of a globe whose diameter is 35 inches? Ans. 3850 sq. in.

3. How many square inches on the surface of a ball $2\frac{1}{2}$ inches in diameter? Ans. $25\frac{1}{2}$ sq. in.

4. If a sphere is $4\frac{3}{4}$ inches in diameter, how many square inches on the surface? Ans. $71\frac{3}{4}$

5. If you have an India-rubber ball $3\frac{1}{2}$ inches in diameter, how many square inches on the outside?

Ans. $38\frac{1}{2}$ sq. in.

2 PROP. To find the solidity of a sphere.

RULE.

Cube the diameter and multiply by .5236, and point off four figures from the right. Or, place the diameter three times on the right, and 11; and on the left, 21 or its factors.

NOTE. We generally work by the last rule.

6. How many solid inches in a sphere of 21 inches diameter? Ans 4851 cu. in.

OP.	21	
	21	
	21	
	11	$\times 21 \times 21 = 4851$ cu. in.

7 How many solid inches in a sphere of 42 inches diameter? Ans. 38808 cu. in.

8. Required the solid inches in a sphere $3\frac{1}{2}$ inches in diameter? Ans. $22\frac{11}{24}$ cu. in.

9. I have a hollow sphere, the diameter of which is 31 inches, now, the shell being half an inch thick, how many gallons of water will it hold?

Ans. $61\frac{1}{2}$ gal.

10. If we have a hollow sphere 5 feet and 5 inches in diameter, with a shell 1 inch in thickness, how many bushels would it hold, counting 2150 cubic inches to the bushel?

Ans. 60 bu. 3 pks. 5 qts.

NOTE. The numbers 3.1416, .7854, .5236, &c., should be well understood by the student in consequence of their frequent use in the solution of superficies and solids in mensuration.

The first (3.1416) expresses the *ratio* of the *circumference* of a circle to the *diameter*. The second, (.7854) the *ratio* of the *area* of a circle to the square of the *diameter*; and the third, (.5236) the *ratio* of the *solidity* of a sphere to the *cube* of the *diameter*. Thus, $3.1416 \div 4 = .7854$; $3.1416 \div 6 = .5236$.

LUMBER.

RULE.

To the right of the vertical line place the dimensions; to the left 12, or its component parts. Should there be mixed numbers, see caution, page 35.

EXAMPLES.

1. How many feet are there in 15 boards 24 feet long, and 11 inches wide? Ans. 330 ft.

$$\begin{array}{r|l} \text{Op. } 12 & 24 \\ & 15 \\ & 11 \times 15 \times 2 = 330 \text{ ft. Ans.} \end{array}$$

2. How many feet are there in 36 plank 12 feet long, 8 inches wide? Ans. 288 ft.

3. How many feet of lumber are there in 20 joist which are 18 feet long, 5 inches wide, and 3 inches thick? Ans. 450 ft.

4. How many feet are contained in 18 sleepers 15 feet long, 10 inches wide, and 3 inches thick? Ans. 675 ft.

5. How much lumber is contained in 25 scantling 3 by 4 inches, 15 feet long? Ans. 375 ft.

6. How many feet of lumber are contained in 6

plank, $12\frac{1}{2}$ inches wide, 2 inches thick, and $12\frac{1}{2}$ feet long?
 Ans. $156\frac{1}{2}$ ft.

7. How many feet of lumber are contained in 20 pieces of scantling, 4 by 3, 12 feet long, and 60 pieces of weather-boarding, 6 inches wide, 12 feet long?
 Ans. 600 ft.

8. How many feet in a sill 11 inches square, and 21 feet long?
 Ans. $211\frac{1}{3}$ ft.

9. How many feet in a bill of lumber containing 240 planks, $11\frac{1}{4}$ feet long, $9\frac{7}{8}$ inches wide, $1\frac{9}{17}$ inches thick?
 Ans. 4000 ft.

10. How many feet are contained in 16 planks that are 8 inches wide, 9 feet long?
 Ans. 96 ft.

11. What is the cost of 32 plank, $16\frac{1}{2}$ feet long, $6\frac{1}{2}$ inches wide, at $\$1\frac{1}{2}$ per hundred?
 Answer, \$5.00

12. What is the cost of 840 palings, 6 feet long, 4 inches wide, at $\$1$ per hundred feet?
 Answer, \$12.60

13. What will 10 pieces of hickory timber, for axles, cost, 7 feet long, 6 by 4 inches, at $\$2\frac{1}{2}$ per hundred feet?
 Answer, $\$3\frac{1}{2}$

NOTE. If the board *tapers*, add the width of the two ends together, and take half of it for the mean width.

14. What are the contents of a tapering board 12 feet long, and 14 inches at one end, and 6 inches at the other?
 Answer, 10 ft.

15. What are the contents of 24 tapering boards, 16 feet long, 8 inches wide, at one end, and 4 inches

at the other, also the cost at \$1 $\frac{1}{2}$ per hundred?

Answer, 192 ft.

Cost, \$2.40 cts.

NOTE. If the scantling tapers both in width and thickness, add the areas of the two ends together; take half the sum and work as before.

16. A piece of lumber 20 feet long, is 10 inches square at one end, 6 inches square at the other; how many feet does it contain?

Answer, 113 $\frac{1}{2}$ ft.

17. How many feet, board measure, are there in a rafter 30 feet long, 4 inches by 3 at one end, and 3 by 2 at the other?

Aus. 22 $\frac{1}{2}$ ft.

18. How many feet of the same measure are there in 10 scantling, 20 feet long, 5 by 4 inches at one end, and 3 by 2 at the other?

Aus. 216 $\frac{2}{3}$ ft.

NOTE. *In these last examples, we have, we think, given the rule in common use among sawyers.*

19. What will be the cost of 120 rafters, 18 feet long, 4 inches by 3 at one end, and 2 inches by 2 at the other end, at \$1 $\frac{1}{2}$ per hundred?

Aus. \$24

20. How many feet in, and what will be the cost of the following bill of lumber: 240 pieces of weather-boarding, 12 feet long, 6 inches wide, 40 pieces of scantling, 10 feet long, 4 inches by 3, 12 door posts, 10 feet long, 4 inches by 6, 72 rafters 16 feet long, 4 inches by 3 at one end, and at the other 3 inches by 2—all at \$1 $\frac{1}{2}$ per hundred?

Answer, 2944 ft.

\$44.16

NOTE. Lumber is now measured by *board meas-*

ire, at most saw-mills, which throws every kind of umber into *one inch* plank or pieces, and sold by the square foot. When a *plank* or *scantling* is said to ontain 8 feet (or any number) it simply contains 8 *quares 12 inches each way*, and *1 inch thick*.

Our rules are the rules in use with saw-mill men ; nd in our questions, if a greater or less thickness is iven it is expressed, if just one inch, the thickness s omitted.

BARK AND WOOD MEASURE.

RULE.

Put the dimensions of the wood or bark on the ight, and 128, or its factors, on the left.

NOTE. The 128 is the number of solid or cubic t. in a cord. Multiplying the length, width and height ogether, gives the solid feet in the pile, and divid- ng by 128 gives the cords.

EXAMPLES.

1. How many cords of wood in a pile 80 feet, 20 eet, 16 feet ? Ans. 200 cords.

$$\begin{array}{r|l} \text{OP. } 8 & 80 \\ 16 & 20 \times 10 = 200 \text{ cords.} \\ & 16 \end{array}$$

2. How much will I have to pay, at \$4 per cord, or a pile of tan bark 128 feet long, 30 feet wide, nd 10 feet in height ? Ans. \$1200

$$\begin{array}{r|l} \text{OP. } 128 & 128 \\ & 30 \\ & 10 \\ & 4 \times 30 \times 10 = \$1200 \text{ Ans.} \end{array}$$

3. How many cords in a pile of bark 24 feet ong, 20 feet wide, and 8 feet high ?

Ans. 30 cords.

4. How many cords in a pile 40 feet, 4 feet, and 8 feet?
 Ans. 10 cords.

5. How many cords in a pile of wood $37\frac{1}{2}$ feet long, $10\frac{3}{4}$ feet wide and $8\frac{1}{2}$ feet high? Ans. $27\frac{1}{2}$

6. If I pay $\$4\frac{2}{3}$ per cord for tan-bark, what will a pile 64 feet long, $4\frac{3}{4}$ feet wide, and $3\frac{1}{2}$ feet high, cost me?
 Ans. $\$35$

Shingles to cover a house.

RULE.

Place the length of the plate, with twice the length of the rafter and two 12's on the right, and on the left, place the width of a shingle, and the number of inches exposed to the weather.

How many shingles will it take to cover a house 24 feet long, allowing the rafters to be 8 feet long and the shingles 4 inches wide, and show 6 inches?

Ans. 2304

Op.		24=length of plate.
¢		16=twice the length of rafters.
¢		12 } are used to reduce the roof to square
		12 } inches.
		$3 \times 24 \times 16 \times 2 = 2304$ shingles Ans.

2. I have a barn 60 feet long, rafters 18 feet, covered with two feet boards, 4 inches wide, showing 8 inches, how many boards on it?

Ans. 9720 boards

3. A certain church is 40 feet long, rafters 15 feet, and covered with shingles 4 inches wide, 5 inches exposed, what did the shingles cost at $\$3\frac{1}{2}$ per thousand?
 Ans. $\$32.40$

4. A farmer builds 12 stables, each 10 feet long, with rafters 7 feet, and covers them with three feet boards, $3\frac{1}{2}$ inches wide, showing 1 foot, how many boards did it take? Ans. 5760

5. How many shingles on a house 24 feet by 18 feet, provided the rafters are $10\frac{1}{2}$ feet long, and the shingles $3\frac{1}{2}$ inches wide on an average, and showing 6 inches? Ans. 3456

To find the number of brick to build a wall.

RULE. .

Place the length, height and thickness, in feet, on the right, with three 12's (to reduce to solid inches,) and on the left, place the dimensions of a brick.

1. How many brick will be required to build a wall 30 feet long, 8 feet high, and 3 feet thick, with brick 8 inches long, 4 by 3 inches? Ans. 12960

$$\begin{array}{r|l}
 \text{OP. } 8 & 30 \\
 3 & 8 \\
 4 & 3 \\
 & 12 \\
 & 12 \\
 & 12 \\
 \hline
 & 3 \times 12 \times 12 \times 30 = 12960.
 \end{array}$$

2. A wall is to be built of brick 9, $4\frac{1}{2}$ and 3 inches, the wall to be 60 feet long, 18 feet high and $1\frac{1}{2}$ feet thick, how many will be required? Ans. 23040

3. A house 30 feet long, 20 feet wide and 10 feet high, was built of brick 8, 4 and 3 inches; how many were used, provided $\frac{1}{5}$ was taken up by mortar, and the wall 1 foot thick? Ans. 14400

RULE.

Place the length and width of the floor and 12 on the right, and on the left, the length and width of a plank.

1. How many planks will be required to lay the floor of a house 30 feet long, 18 feet wide, with plank 12 feet long and 9 inches wide?

$$\begin{array}{r|l} \text{OP} & 30 \times 2 = 60 \text{ ft. Ans.} \\ 12 & 18 \\ 9 & 12 \end{array}$$

2. My house is 50 feet by 40 feet, and floor laid with plank 8 feet long and 5 inches wide; how many plank in the floor? Ans. 600

3. A dwelling is 45 feet long, 22 feet wide and the flooring plank 9 feet long, 5½ inches wide; how many plank will be required? Ans. 240

To find the number of bushels or barrels of shucked corn contained in a crib.

RULE.

Place the dimensions of the crib on the right, with 2. and on the left, 5 for bushels.

1. How many bushels of corn will a crib contain whose dimensions are 15 feet long, 10 feet high, 8 feet wide? Ans. 480 bushels.

2. How many barrels of corn will a crib contain whose dimensions are 20 feet long, 12 feet high, 6 feet wide? Ans. 115½ bbls.

3. How many barrels of corn are there in a crib 20 feet long, 12 feet high, 10 feet wide? Ans. 192 bbls.

4. I have a crib $15\frac{3}{4}$ feet long, $7\frac{1}{7}$ feet high, and $6\frac{2}{5}$ feet wide, what are the contents in barrels?

Ans. $57\frac{3}{5}$ bbls.

To find the number of barrels of shelled corn in a box.

RULE.

Place the dimensions (in feet) with 4, on the right, and on the left place 5.

How many bushels of wheat will a box contain that is 5 feet long, 4 feet wide and 3 feet deep?

Ans. 48 bus.

6. I have a granary $12\frac{1}{2}$ feet long, $8\frac{2}{5}$ feet wide, $4\frac{1}{2}$ feet deep; how many bushels will it hold?

Ans. $367\frac{1}{2}$ bus.

NOTE. Complete accuracy is not to be expected from any rule to guage a crib. The above rule is the most correct of any discovered.

GEARING.

To find how often a *gin, thresher, drum, pulley* or *spindle*, will revolve, while the first, or cog-wheel, is making one revolution.

RULE.

Place the drivers on the right; and on the left, place the drivens. If the driven is in inches, place 12 under the driver.

NOTE. The *first wheel*, in machinery, is a *driver*, and the second, is a *driven*, and so on.

1. How many revolutions will a gin make to one of the cog-wheel, with the cog-wheel 12 feet

in diameter, the pinion 12 inches, the band-wheel 8 feet, and the pulley 4 inches? Ans. 288

$$\begin{array}{r|l} \text{Op.} & \begin{array}{l} \cancel{12} \\ 12 \\ \cancel{4} \\ 8 \end{array} \\ & 12 \times 2 \times 12 = 288 \text{ Ans.} \end{array}$$

2. We have a thresher driven by the following size gearing : Cog-wheel 300 cogs, pinion 15 cogs, band wheel 7 feet, pulley 14 inches, second band-wheel 5 feet, pulley at the thresher 5 inches ; what is the speed ? Ans. 1440 rev.

3. In the gearing of a thresher the first wheel is 9 feet in diameter, the second, 14 inches, the third 7 feet, the fourth 12 inches, the fifth 4 feet and 6 inches, and the sixth wheel or pulley 6 inches ; how many revolutions will the thresher make, while the "horses are going round one time ?" Ans. 486 rev.

CYLINDERS.

A *cylinder* is a round solid, of uniform diameter, with circular ends.

To find the *solidity* of a cylinder.

RULE.

Place the diameter twice on the right, with its length, and 11 ; and on the left, 14, or its factors.

EXAMPLES.

1. How many solid inches in a cylinder 14 inches in diameter, and 20 feet long ? Ans. 3080 inches.

$$\begin{array}{r|l} \text{Op.} & \begin{array}{l} \cancel{14} \\ 14 \\ 20 \end{array} \\ & 11 \times 14 \times 20 = 3080 \text{ inches Ans.} \end{array}$$

2. What is the solidity of a round log 28 inches in diameter, and 10 feet long? Ans. $42\frac{7}{8}$ solid ft.

3. I have a round scantling $3\frac{1}{2}$ inches in diameter, and 12 feet long; how many solid inches in it?
Ans. $115\frac{1}{2}$ inches.

4. What is the solidity of a round log $10\frac{1}{2}$ inches in diameter, 16 feet long? Ans. $9\frac{5}{8}$ solid ft.

GAUGING CASKS.

RULE.

Take the distance in inches from the centre of the bung inside, diagonally, to the chime; cube it, and divide by .370, and the quotient will express the gallons. Should there be a remainder multiply by 4, and continue the division for quarts, by 2, for pints, &c.

NOTE. If the bung is not in the centre, measure both ways to chime, add the two results together, and take half the sum—then proceed as above.

EXAMPLES.

1. How many gallons will a hogshcad hold measuring 37 inches from the centre of the bung inside, to the chime? Ans. 136 gals. 3 qts. 1 pt.

OPERATION.

$$37 \times 37 \times 37 = 50653 \div 370 = 136 \text{ gallons.}$$

$$\text{1st remainder } 333 \times 4 = 1332 \div 370 = 3 \text{ quarts.}$$

$$\text{2d remainder } 222 \times 2 = 444 \div 370 = 1 \text{ pint.}$$

2. A cask measures 16 inches from the centre of the bung, diagonally, to the chime, what is its capacity? Ans. 11 gals. 2 gills.

3. A cask measures 18 inches, diagonally, to the chime inside, one way, and 19 inches the other, what will it hold? Ans. 17 gals. and 3+ gills.

4. I have a small cask measuring 13 inches to the chime inside, what does it hold?

Ans. 5 gals. 3 qts. 1 pt. 2 gills.

PROMISCUOUS EXAMPLES.

1. A farmer sells 4 tons of hay at \$12 per ton, 80 bushels of wheat at \$1 per bushel, and takes, in part payment, a wagon at \$40, and a cart at \$20, and the rest in cash, which he divides equally among his 4 sons ; what was the share of each ?

Ans. \$17

2. J. H. Banks bought a farm for \$18050. He sold 50 acres for \$60 per acre, and the remainder stood him in \$50 per acre; how many acres did he buy? Ans. 351 acres.

Ans. 351 acres.

3. Multiply $\frac{5}{8}$ of $\frac{4}{5}$ of 9 by $6\frac{3}{7}$ of 14. Ans. 549

4. I own $\frac{2}{7}$ of a ship, and sell $\frac{1}{3}$ of $\frac{1}{9}$ of my share; what part is it of the whole ship? Ans. $\frac{2}{63}$

5. Sol $1\frac{2}{3}$ of $\frac{3}{4}$ of $26\frac{1}{2}$ lbs. of rice, for $\frac{1}{4}$ of $2\frac{1}{2}$ of $10\frac{8}{5}$ cts. a pound; what did it come to? Ans. $83\frac{15}{8}$ cts.

6. What is the value of $\frac{3}{7} \times \frac{7}{11} \times \frac{1}{4} \times 100$? Ans. $12\frac{1}{2}$

7 Divide $1\frac{1}{15}$ by $\frac{1}{15}$ of 1. Ans. 16

8. Divide $4\frac{2}{7}$ dollars among 15 boys, and tell me the share of each. Ans. $28\frac{4}{7}$ cts.

9. Gave $7\frac{7}{10}$ bushels of rye, for a barrel of flour ; how much rye will it take to buy $7\frac{1}{2}$ barrels of flour ?

Ans. 55 bus.

10. Bought 15 loads of wood, each containing $11\frac{2}{3}$ feet, and divided it among 9 persons ; what does each get ?

Ans. 19 ft.

11. I loaned J. F. Harrison \$700, which he kept 20 months. Some years after, I borrowed from him \$300 ; how long should I keep it to balance the favor ?

Ans. $46\frac{1}{3}$ mos.

12. A. and B. set out to travel round a certain island, which is 80 miles in circumference. A. travels 5 miles a day, and B. 7 miles a day ; How far must B. travel to overtake A ?

Ans. 280 miles.

13. A wall of 700 yards in length, was to be built in 29 days ; twelve men were employed on it for 11 days, and only completed 220 yards ; how many men must be added to complete the wall in the required time ?

Ans. 4

14. A floor 30 feet long, and 18 feet wide, is to be covered with painted cloth $\frac{3}{4}$ of a yard wide, how many yards will cover it ?

Ans. 80 yds.

15. A man having a house and lot for sale, was offered for them \$1122 in cash, or \$1221 payable in 10 months ; he chose the latter. How much money, at 12 per cent. did he lose ?

Ans. \$12

16. I have sent to my agent, a certain sum of money, which he is to lay out for me in iron, and having reserved to himself $2\frac{1}{2}$ per cent. on the purchase, which amounted to \$90, he buys for me the

iron, at \$95 per ton; what was the sum remitted, and the tons of iron purchased?

Ans. \$3600, and $37\frac{17}{19}$ tons.

17. A ship is valued at \$35,000, and the cargo at \$75,000. The owner has $\frac{3}{5}$ of the value of the ship insured at $3\frac{1}{2}$ per cent., and $\frac{2}{3}$ of the cargo, at $2\frac{1}{2}$ per cent.; what is the amount of premium?

Ans. \$1932.50

18. Bought 24 yards of cloth for \$64.864 $\frac{3}{4}$, and sold it at \$2.50 per yard; what per cent. was lost?

Ans. $7\frac{1}{2}$ per cent.

19. Sold a horse for \$75, and lost 25 per cent. whereas, I should have gained 30 per cent. How much was he sold under his real value? Ans. \$55

20. If 3 men, in 7 days, dig a well 42 feet deep and 5 feet in diameter, what is the diameter of a well that 4 men, in 8 days, dig to the depth of $44\frac{4}{5}$ feet?

Ans. 6 ft.

21. A. buys of B. two bags of cotton, each weighing 450 lbs. at $10\frac{1}{4}$ cts. per lb. He pays him \$20 in cash, and a note on C. given for \$60, which has been on interest 8 months at 7 per cent. and is to pay the balance in coffee at 9 cts. per lb.; how many pounds of coffee will B. receive? Ans. 105 lbs.

22. If a sphere, 4 inches in diameter, weighs $3\frac{1}{5}$ pounds, what will be the weight of one 20 inches in diameter?

Ans. 400 lbs.

23. Three men rent a pasture for \$8.80. A. puts in 5 colts for 17 weeks, B. puts in 5 colts for 15

weeks, C. 3 colts for 20 weeks; how much ought each to pay of the money?

Ans. $\left\{ \begin{array}{l} \text{A. \$3.40} \\ \text{B. \$3.00} \\ \text{C. \$2.40} \end{array} \right.$

24. A cubical excavation of earth, a side of which, was 6 feet—was dug by 4 men in 6 days working 8 hours a day. Another similar excavation was dug by 2 men, in 48 days of 16 hours each; what was the length of a side? Ans. 12 feet.

25. The area of a circular island is 2464 square rods, what is the diameter of the island?

Ans. 56 rods.

26. How much will it cost to carpet a parlor 18 feet square, with carpeting $\frac{1}{4}$ of a yard wide, if the carpeting is worth $\$1\frac{1}{2}$ per yard? Ans. \$72

27. How many yards of paper, that is 30 inches wide, will it require to cover the walls of a room that is $15\frac{1}{2}$ feet long, $11\frac{1}{4}$ feet wide, and $7\frac{1}{4}$ feet high?

Ans. $55\frac{7}{8}$ yards.

28. Bought 55 sacks of salt, at 85 cts. per sack, $\frac{1}{5}$ of which I sold at a loss of 15 per cent. and the remainder, I sold at an advance of 80 per cent.; what did I clear by the whole transaction?

Ans. \$1.87 cents.

29. I bought 40 sacks of flour, at $\$4\frac{1}{2}$ per sack, which I bargained to Gray & Co., at an advance of 20 per cent. for 25 barrels of corn, at 95 cts. a bushel, 35 bushels of wheat, at $\$1\frac{1}{4}$ per bushel, 48 bushels of rye, at $62\frac{1}{2}$ cts. per bushel, and 136 pounds of coffee; what was I charged per pound, for the coffee?

Ans. $17\frac{1}{2}$ cents.

30. We have 670 bushels of oats, which cost us 35 cts. per bushel ; but we barter them to T Bishop & Son, at 50 cents per bushel, for flour, which cost them \$5 per barrel ; what is the bartering price of the flour at the same per cent., and how many barrels will we receive ?

Ans. \$7.14 $\frac{2}{3}$ per bbl. and 46 $\frac{9}{10}$ bbls.

31. Bought, for cash, 450 barrels of corn, at \$3 $\frac{1}{2}$ per barrel, and sold immediately, at \$4. on 6 months' credit, for which I received a note. Should I get this note discounted, at 6 per cent. at the Bank of Athens, what will I gain on the corn ?

Ans. \$170.10

32. What is the difference between the interest of \$40, at 7 per cent. for 4 years, and the discount on it for the same time ?

Ans. \$2.45

33. A merchant purchased 200 yards of cloth, at \$3 per yard. A customer who was desirous of speculating, proposed to take \$300 worth of the cloth, at \$2.75 per yard, and then give \$3.25 per yard for the remainder ; what did the merchant lose by the transaction ?

Ans. \$4.54 $\frac{6}{11}$

34. A hare starts 12 rods before a greyhound, but is not perceived by him till she has been up 45 seconds ; she scuds away at the rate of 10 miles an hour, and the dog after her at the rate of 16 miles an hour ; what space will the dog run before he overtakes the hare ?

Ans. 138 $\frac{2}{3}$ rods.

APPENDIX.

Forms of Notes, Receipts, Deeds, Wills, &c.

NEGOTIABLE NOTE.

\$500. Six months after date, I promise to pay *Robert P. Simmons*, or bearer, *Five hundred Dollars*, for value received. *March 1st, 1861.*
RICHARD ROE.

NEGOTIABLE BY ENDORSEMENT.

\$700. Twelve months after date, I promise to pay *George H. Doe*, or order, *Seven hundred Dollars*, for value received. *Feb. 10th, 1861.*
PETER PAYWELL.

NOT NEGOTIABLE.

\$300. Ninety days after date, I promise to pay *Robert D. Flint*, *Three hundred Dollars*, for value received. *Feb. 1st, 1861.*
M. C. DUNN.

JOINT NOTE.

200 $\frac{90}{100}$. Twelve months after date, we, or either of us, promise to pay *Wm. D. Stone* or bearer, *Two hundred and $\frac{90}{100}$ Dollars*, for value received, *Feb. 1st, 1861.*
A. C. HAMIL.
P. P. CLINCH.

JOINT NOTE.

\$2000. On, or before, the 25th of *December* next, we, or either of us, promise to pay *Benj. D. Anderson*, administrator on the estate of *Thos. E. D. an. deceased*, or bearer, *Two thousand Dollars*, for value received. *Feb. 10th, 1861.*
ROBERT DOE.
RICHARD ROE.

JOINT SEAL NOTE.

\$500. Twelve months after date, we, or either of us, promise to pay *B. A. Forts*, executor of the estate of *F. N. Forts*, dec'd., or bearer, *Five hundred Dollars*, for value received. Witness our hands and seals, this 1st Feb. 1861.
E. S. FROST, [L.S.]
P. P. CROOK, Sec'y. [L.S.]
W. C. ROE, Sec'y. [L.S.]

NOTE ON DEMAND.

\$575 $\frac{9}{100}$. On demand, I promise to pay *N. W. Doe*, or order, *Five hundred and seventy five and $\frac{9}{100}$ Dollars*, for value received. *March 1st, 1861.*
JOHN G. TWIST.

DUE BILL.

\$900 $\frac{75}{100}$. Due *Daniel D. Daniel*, or bearer, *Nine hundred and $\frac{75}{100}$ Dollars*, for value received. *Feb. 10th, 1861.*
JOHN P. PORTER.

SHERIFF'S RECEIPT.

John Doe, } Received, Feb. 10th 1861, of Debt. *Four hundred dol-*
vs. } *lars and 50 cts.* in full, of principal, interest and cost,
W. C. Roe. } in the within case. JAS. MARTIN, Sh'ff

DISTRIBUTEE'S RECEIPT.

Received, *January 10th, 1861,* of *M. P. Smith, Administrator* on the estate of *Wm. Smith, deceased, Two negroes,* one named *John,* and the other *Martha,* as my full distributive share of the *negroes* of said estate.

WM. P. RAE.

GUARDIAN'S RECEIPT.

GEORGIA, } Received, *January the first,* eighteen hundred
Oglethorpe County. } and *sixty-one,* of *Samuel C. Crane,* Guardian of the minor heirs of *Henry M. South,* late of said county, deceased, *Three hundred dollars,* in full, entire and complete satisfaction of all the right, title, interest, property, claim, or demand, I have, or might have, in and upon the estate, real and personal, of said *Henry M. South,* deceased. And the said *Samuel C. Crane,* Guardian, aforesaid, is hereby, fully and entirely discharged and acquitted, of any, and all further claim on my part, upon said estate.

In testimony whereof, I have herenunto set my hand and affixed my seal the day and year first above written.

Signed, sealed and delivered,

in presence of

*John Trust,**Wm. H. Pruitt, J. P.*

WM. P. SOUTH. [L.S.]

REFUNDING BOND.

STATE OF GEORGIA, } Know all men by these presents, that we,
Oglethorpe County. } *Samuel M. Sanders,* and *John J. Cummings,* security, of said county, are held and firmly bound unto *Simeon A. Crook,* administrator upon the estate of *Willis C. Clinch,* late of said county, deceased, in the just and full sum of *Two thousand dollars,* for the true payment of which, we bind ourselves, our heirs, executors and administrators, jointly, severally and firmly, by these presents: Sealed with our seals, and dated this *January 10th, 1861.*

The condition of the foregoing obligation is such, that whereas, the said *Simeon A. Crook,* administrator as aforesaid, has divided among the distributees of said deceased, the entire estate of said deceased; and whereas, the said *Samuel M. Sanders,* has received from the said *Simeon A. Crook,* administrator as aforesaid, his distributive share of said estate, it being *one-sixth;* now, should the said *Samuel M. Sanders,* well and truly pay his proportionable part of any debt which may hereafter be established against *Simeon A. Crook,* as administrator of said *Willis C. Clinch,* deceased, and his proportionable part of the costs, attending the recovery of said debt, then this obligation to be void; else to remain in full force and virtue.

Tested and approved, by

Wm. H. Pruitt, J. P.

SAMUEL M. SANDERS.

JNO. J. CUMMINGS, security. [L.S.]

ADMINISTRATOR'S BOND.

STATE OF GEORGIA, } Know all men by these presents, that we,
Oglethorpe County. } *James Sanders*, principal, *Julius Smith*
 and *Robert Anderson*, securities, are held and firmly bound unto the
 Justices of the Inferior Court, when sitting for ordinary purposes, for
 said county, and their successors in office in the just and full sum of
Five thousand dollars, for the payment of which sum, the said
 justices and their successors, we bind ourselves, our heirs, executors
 and administrators, in the whole, and for the whole sum jointly and
 severally and firmly by these presents: Sealed with our seals and
 dated this 1st Feb 1861.

The condition of the above obligation is such, that if the above
 bound *James Sanders*, administrator of the goods and chattles of *John*
Stephens, late of said county, deceased, do make a true and perfect in-
 ventory of all the goods, chattels and credits, of the said deceased,
 which have or shall come into the hands, possession or knowledge of
 the said *James Sanders*, or into the lands or possession of any other
 person, or persons, for him; and the same so made, to exhibit into the
 said Court of Ordinary, when he shall be thereunto required; and
 such goods, chattels and credits do well and truly administer accord-
 ing to law, and do make a just and true account of his actings and
 doings thereon, when required by the Superior Court, or register of
 probates for this county. And all the rest of the goods, chattels and
 credits which shall be found remaining upon the account of the said
 administration, the same being first allowed by the said Court, shall
 deliver and pay such persons, respectively, as are entitled to the same
 by law, and if it shall hereafter appear, that any last will and testa-
 ment was made by said deceased, and the same be proved before the
 Court, and the executors obtain a certificate of the probate thereof,
 and the said *James Sanders* do in such case, if required, render and
 deliver up the said letters of administration, then this obligation to be
 void; else remain in full force.

Signed, Sealed and	}	JAS. SANDERS, Prin.	[L.S.]
acknowledged in open Court.		JULIUS SMITH, Sec'y.	[S.S.]
J. P. Roe, C. C. O.		ROBT. ANDERSON Sec'y.	[L.S.]

BOND FOR TITLES TO LAND.

STATE OF GEORGIA, } Know all men by these presents, that I,
Oglethorpe County. } *James Roe*, of the county aforesaid, am
 held and firmly bound unto *Silas Crane* of the same place, his heirs,
 executors and administrators, in the just and full sum of *one thousand*
dollars; for the true payment of which, I bind myself, my heirs, ex-
 ecutors and administrators, jointly, severally, and firmly by these pre-
 sents: Sealed with my seal, and dated this *January 16th*, 1861.

The condition of the above obligation is such, that whereas, said
Silas Crane has, *this day*, made and delivered to me said *James Roe*,
 his certain *promissory note*, for the sum of *five hundred dollars*, to be-
 come due on the *first day of January* next: now, should the said
Silas Crane well and truly pay said *promissory note*, then I, the said
James Roe, bind myself to make, or cause to be made, to said *Silas*
Crane, good and efficient titles, in *fee simple*, to and for *lot of land*,
 situate, lying and being in said county, (HERE DESCRIBE THE LOT OF
 LAND.) with all the rights, members and appurtenances, to said *lot of*

land, in any way appertaining and belonging, which, if I, the said James Roe, should do, then this bond to be null and void; else, to remain in full force and virtue.

Tested and approved by
James P. Williams, J. P.]

JAMES ROE. [L.S.]

FEE SIMPLE DEED.

STATE OF GEORGIA, } This Indenture, made this the *sixteenth*
Oglethorpe County. } day of *January*, in the year of our Lord,
eighteen hundred and *sixty-one*, between *Samuel Skinner, of the county*
and *State aforesaid*, of the one part, and *John Phillips, of the same*
place, of the other part, witnesseth that the said *Samuel Skinner*, for
and in consideration of the sum of *one thousand dollars*, to him in
hand paid, at and before the sealing and delivery of these presents,
the receipt thereof is hereby acknowledged, hath granted, bargained,
sold and conveyed, and doth, by these presents, grant, bargain, sell,
convey, confirm, and deliver, unto the said *John Phillips*, his heirs and
assigns, all that tract or parcel of land, situate, lying and being
in said county aforesaid, (*if the land originally belonged to another*
county so state it in this part of the deed) on the waters of *Beaverdam*
creek, containing *one hundred acres*, be the same more or less, (*here de-*
scribe the land by metes and bounds.)

To have and to hold said tract or parcel of land unto the said *John Phillips*, his heirs and assigns, together with all and singular, the rights, members and appurtenances thereof, to the same in any manner belonging, to his and their own proper use, benefit and behoof, forever, in fee simple.

And the said *Samuel Skinner*, for himself, his heirs, executors and administrators, the said bargained premises, unto the said *John Phillips*, his heirs and assigns, with warrant and forever defend the right and title thereof, against themselves and against the claims of all other persons whatever.

In witness whereof the said *Samuel Skinner* hath hereunto set his hand and seal, the day and year above written.

Signed, Sealed and
delivered in presence of
Robert C. Trust,
Edmond Crane, J. P.

SAMUEL SKINNER, [L.S.]

DEED OF GIFT.

STATE OF GEORGIA, } This Indenture made this *first* day of
Oglethorpe County. } *January*, in the year of our Lord, eighteen
hundred and *sixty-one*, between *James Williams, of said State and*
county, of the one part, and *Augustus C. Williams, grandson of the*
said *James Williams, of the same place*, of the other part, witnesseth
that the said *James Williams* for and in consideration of the natural
love and affection which he has and bears to his said grandson,
Augustus C. Williams, hath given, granted, and conveyed, and does by
these presents, give, grant, and convey, unto the said *Augustus C. Wil-*
liams, his heirs and assigns, all that tract or parcel of land, situate,
lying and being in said county, (*HERE DESCRIBE THE LAND.*)

To have and to hold said tract of land unto him, the said *Augustus C. Williams*, his heirs and assigns: together with all and singular

the rights, members and appurtenances to the same in any manner belonging, to his and their own proper use, benefit, and behoof, *forever*, in *fee simple*.

In testimony whereof, the said *James Williams* hath hereunto set his hand and affixed his seal, the day and year first above written.

Signed, Sealed and

delivered in presence of

John P. Runnels,

Samuel J. Trust, J. P.

JAMES WILLIAMS, [L.S.]

NOTE. Persons wishing to convey *personal property*, by making such alterations, as will suggest themselves, the above form will answer.

QUIT-CLAIM DEED.

STATE OF GEORGIA, } This Indenture, made and entered into
Oglethorpe County. } this *first* day of *January*, in the year of

our Lord, eighteen hundred and *sixty-one*, between *John Dae*, of the *State and county* aforesaid, of the one part, and *Richard Rae* of the *same place*, of the other part, witnesseth that the said *John Dae*, for, and in consideration of the sum of *one hundred* dollars, cash in hand paid, the receipt whereof is hereby acknowledged, hath bargained and sold, and doth by these presents, remise, release, and forever quit claim to said *Richard Rae*, his heirs, and assigns, all the right, title, interest, claim, demand, the said *John Dae* has, or may have had, in and to a lot of land, situate, lying and being in said county, (*here describe the land.*) with all the rights, members and appurtenances to said *lot of land*, in any wise belonging or appertaining.

To have and to hold the said lot of *land* unto the said *Richard Rae*, so that neither the said *John Dae*, nor his heirs, nor any other person or persons claiming under him, shall at any time hereafter, by any way or means have, claim or demand, any right or title to the aforesaid *lot of land* or its appurtenances, or part thereof.

In testimony whereof, the said *John Dae* hath hereunto set his hand and affixed his seal, the day and year above written.

Signed, Sealed and

delivered in presence of

Daniel H. Hunt,

Robt. P. Smack, J. P.

JOHN DAE, [L.S.]

DEED OF TRUST.

STATE OF GEORGIA, } This Indenture, made and entered into
Oglethorpe County. } this the *first* day of *January*, in the year of

of our Lord, eighteen hundred and *sixty-one*, between *Samuel Snow*, of said *State and county*, of the one part, and *Robberson Smith* of the *same place*, of the other part, witnesseth, that the said *Samuel Snow*, for, and in consideration of the natural love and affection which he has and bears for his daughter, *Mary Ann Thompson*, of said *State and county*, wife of *Willis P. Thompson*, and for and in consideration of the sum of *five* dollars, cash in hand paid, by the said *Robberson Smith*, at and before the sealing and delivery of these presents, the receipt whereof is hereby acknowledged, hath granted, bargained, sold and conveyed, and by these presents doth grant, bargain, sell and convey unto the said *Robberson Smith*, for the use, benefit and advantage, in trust, for said *Mary Ann Thompson*, the children she now has, and

those she may hereafter have by her present or future husband, free from the control or disposition of her present or a future husband ; all that *tract or parcel of land*, situate, lying and being in said county, (*here describe the land fully by its metes and bounds,*) with all the rights, members and appurtenances, to said *tract of land* in any wise appertaining or belonging. (And also a *negro fellow*, named *John*, about *thirty* years of age, *five feet four inches* high, of *dark* complexion, and his wife, *Sallie*, about *twenty* years of age, *five feet* high, of *yellow* complexion)

To have and to hold the above described property, unto him, the said *Robberson Smith*, in trust for said *Mary Ann Thompson, wife of said Willis P. Thompson*, and all her children as aforesaid, *forever in fee simple*, (free from all the debts, dues, liabilities, and control of her present, or a future husband,) to their only benefit and behoof.

In witness whereof, the said *Samuel Snow* hath hereunto set his hand and affixed his seal the day and year above written.

Signed, Sealed and

delivered in presence of {

John Reel,

Willis Roe, J. P

SAMUEL SNOW, [L.S.]

ADMINISTRATOR'S DEED.

STATE OF GEORGIA, } This Indenture, made this *first day* of
Oglethorpe County, } *January*, in the year of our Lord, eighteen
 hundred and *sixty-one*, between *John Doe*, of the State and county
 aforesaid, duly constituted administrator of the estate of *Richard Roe*,
 late of said State and county, deceased, of the one part, and *James*
Smith, of the *same place*, of the other part, witnesseth, that whereas,
 by virtue of an order, granted by the Honorable Court of Ordinary of
 said county, when sitting for ordinary purposes, previous notice of
 application having been given agreeably to the statute, in such case
 made and provided on the *first Monday in October last*, to said *John*
Doe, administrator as aforesaid, to sell a *tract of land* belonging to
 the estate of said deceased, situate, lying and being in the county and
 State aforesaid, (*here describe the land as minutely as possible,*) with
 the rights, members and appurtenances thereunto belonging. After
 the said *tract of land* was duly advertised, in conformity to law, the
 same was put up and exposed to sale, to the highest bidder, at the door
 of the court house at *Lexington*, in said county, within the legal hours
 of sale, on the first Tuesday in *December last*, by said *John Doe*, admin-
 istrator as aforesaid, when said *tract of land* was knocked off to said
James Smith, at the price or sum of *one thousand* dollars, he being the
 highest and best bidder ; now, for and in consideration of the said sum
 of *one thousand dollars*, cash in hand paid, the said *John Doe*, admin-
 istrator, as aforesaid, by him, the said *James Smith*, at and before the
 sealing and delivery of these presents, the receipt whereof is hereby
 acknowledged, said *John Doe*, administrator, as aforesaid, hath granted,
 bargained and sold, and by these presents, doth grant, bargain and
 sell, unto the said *James Smith*, his heirs, executors, administrators,
 and assigns, the said *tract of land*, situate, lying and being in said
 county, as above described, with all the rights, members and appurte-
 nances thereto belonging, or in any wise appertaining, unto him, the
 said *James Smith*, his heirs, executors, administrators and assigns, to

his and their own proper use, benefit and behoof, *forever in fee simple*.

In witness whereof, the said *John Doe*, administrator, as aforesaid, hath hereunto set his hand, and affixed his seal, the day and year above written.

Signed, Sealed and
delivered in presence of }
Daniel J. Simmons,
John Trust, J. P.

JOHN DOE, Adm'r. [L.S.]
of RICHARD ROE, dec'd.

SHERIFF'S DEED.

STATE OF GEORGIA, } This Indenture, made and entered into
Oglethorpe County } this *eighteenth* day of *March*, in the year
of our Lord, eighteen hundred and *sixty-one*, between *Peter Morris*,
Sheriff of the county aforesaid, of the one part, and *William Swift*,
of the same place, of the other part, witnesseth, that whereas, the
said *Peter Morris*, Sheriff as aforesaid, did lately seize and levy upon
a certain *tract of land*, situate, lying and being in the county aforesaid,
adjoining the land of *E. Christy, R. Gardner*, and others, contain-
ing *one hundred acres* as the property of *G. Mabry*, by virtue of a
writ of *sequestration*, issued from the *Superior Court*, in favor of *Calvin*
Kirkly, against *George Mabry*; and after publicly advertising said
tract of land, agreeably to law, did put up and expose the same to
public out-cry, on the first Tuesday in *Feb. inst* ut, at the court house
door in the town of *Lexington*, in said county, within the legal hours of
sale, when said *tract of land* was knocked off to said *William Swift*, at
and for the sum of *one thousand* dollars, he being the highest and
best bidder; now, for and in consideration of the said sum of *one*
thousand dollars, in hand paid, to him the said *Peter Morris*, Sheriff,
as aforesaid, by him, the said *William Swift*, at and before the sealing
and delivery of these presents, the receipt whereof, is hereby acknowl-
edged, the said *Peter Morris*, sheriff, as aforesaid, hath granted, bar-
gained and sold, and by these presents, doth grant, bargain, and sell,
unto him, the said *William Swift*, his heirs, executors, administrators
and assigns, all the right, title and interest of said *George Mabry* in
said *tract of land* of which said *George Mabry*, was seized and pos-
sessed, in and to the same, with all the rights, members and appurte-
nances thereunto belonging, or in any wise appertaining, to his and
their own proper use, benefit and behoof *forever in fee simple*.

In witness whereof, the said *Peter Morris*, Sheriff, as aforesaid, hath
hereunto set his hand and affixed his seal, the day and year above
written.

Signed, Sealed and
delivered in presence of }
W. W. Rush,
R. R. Mann, J. P.

PETER MORRIS, Sheriff, [L.S.]

FORM OF POWER OF ATTORNEY

STATE OF GEORGIA, } Know all men by these presents, that I,
Oglethorpe County. } *Asa P. Sanders*, of said State and county,
for divers good causes and considerations, me hereunto moving, have
made, ordained and appointed, and by these presents do make, ordain
and appoint, *Sam'l Smith*, of said State and county, my true and law-
ful attorney, for me and in my name, for my own purpose and benefit,

to, (*Here state fully and plainly the object for which the Power of Attorney is made.*)

And to have, use and take all lawful ways and means in my name, or otherwise that may be found necessary, or proper, in the execution of this Power of Attorney. To do all lawful acts and things whatsoever, concerning the premises, as fully, in every respect, as I, myself, might, or could do, were I personally present at the doing thereof; (*And one or more Attorneys under him, for the purposes aforesaid, to make, and again at pleasure to revoke.*)

Ratifying and confirming, and by these presents allowing, whatsoever, my said Attorney shall, in my name, lawfully do, or cause to be done, in and about the premises, by virtue of these presents.

In witness whereof, I have herenunto set my hand and affixed my seal, this Feb. 1st. 1861.

Signed, Scaled and

delivered in presence of

Wm. Mann.

O. C. Smith, J. P.

ASA P. SANDERS, [L.S.]

NOTE. A Power of Attorney may be executed in presence of a Notary Public.

BILL OF SALE.

STATE OF GEORGIA, } Received of *Lewis M. Martin*, one then-
Oglethorpe County. } said dollars, in full payment for a negro
boy by the name of *Harry*, about *nineteen* years old, of *yellow* com-
plexion. I warrant said boy to be sound, both mentally and physically,
I also warrant the right and title, unto the said *Lewis M. Martin*,
against the claim of myself, heirs, executors and administrators, and
against the claim of all other persons whatsoever.

Witness, my hand and seal, this 18th day of Feb. 1861.

Test,

Isaac Mann,

C. C. Goodwin, J. P. }

ROBERT C. RUNNELS, [L.S.]

WRITTEN WILL.

STATE OF GEORGIA, } In the name of God, amen. I, *Robert*
Oglethorpe County. } *Wilson*, of said State and county, being
of sound mind, but in feeble health, and knowing that I must shortly
depart this life, consider it right and proper, both as respects my fam-
ily and myself, that I should make some disposition of my property,
with which a kind Providence has blessed me, do therefore make this, my
last will and testament, hereby revoking all others heretofore made
by me.

I ITEM. I desire that my body be buried in a decent and Christian-
like manner, suitable to my condition and circumstances in life. My
soul, I trust, shall return to rest with God, who gave it, as a hope for
eternal salvation through the merits and atonement of the blessed Lord
and Saviour Jesus Christ, whose religion I have professed, and as I
humbly trust, have enjoyed for twenty years.

2 ITEM. I desire and direct, that all my just debts be paid, without
delay, by my executors hereinafter appointed, as I am unwilling my
creditors should be delayed, in their just rights, especially as there is
no necessity for delay.

3 ITEM. I give, bequeath, and devise to my beloved wife, *Sarah*, with whom I have lived, *in strict quiet for thirty years*, my tract of land whereon I now reside, containing one thousand acres, with all the rights, members, and appurtenances, in any manner appertaining, to her own proper use during her natural life, then to be equally divided between my two sons *Robert* and *William*. I also give and bequeath in the same manner, the farming utensils used and belonging to said plantation, of every description whatever, *five mules*, that she may choose from all my mules; *five cows and calves*, as she may choose from all my stock of cattle, *five hundred bushels of corn*, *six thousand pounds of fodder*; *six sows and pigs*, such as she may choose from all my stock of hogs; and *twenty head of fatening hogs*; all my household and kitchen furniture belonging to and on said plantation, and my carriage and horses during her natural life. The bequest made in lieu of her whole dower.

4 ITEM. I give and bequeath to my beloved wife, *for and during her natural life*, only, my negro man *Harry*, known as my carriage driver, my negro man *Sam* about *thirty years* of age. *Sam's* wife *Sallie*, about *twenty-five years* of age; and their *four* children to wit; *Martha*, ten years of age; *Dick*, *nine years* of age; *Billy* eight years of age; *Mary*, *six years* of age; *Sarah*, known as my cook, about *forty-three years* of age; my negro man *Sam*, about *twenty-seven years* of age; *Tom*, a boy about *eighteen years* of age; *Simon*, a boy about *fifteen years* of age; and *Ann*, a girl about *sixteen years* of age.

5 ITEM. I give, bequeath, and devise to my son *Robt.* my negro man *Titus*, about *thirty years* of age; *Reuben*, a man about *twenty-five years* of age; and his wife, *Phebe*, about *thirty-three years* of age; their four children, to wit: *Martha*, a girl; *Jane*, a girl; *Ben*, a boy, and *Abe*, a boy, to him forever.

6 ITEM. I give, bequeath, and devise to my son *William*, my negro man *Peter*, about *thirty years* of age; *Lot*, about *thirty-two years* of age; and his wife, *Susan*, about *thirty years* of age; and their four children to wit; *Liza*, a girl; *Cena*, a girl; *Charles*, a boy; and *Hop*, a boy, to him forever.

7 ITEM. I give and bequeath to my daughter, *Emma White*, wife of *Henry White*, and all her children that she now has, or may hereafter have by her present or any other future husband; free from the debts, dues, or liabilities of her present or any future husband, in any manner whatsoever; my plantation, known as the Brown plantation, containing *five hundred acres*, all the mules, horses, cattle, hogs, plantation tools of every description; all the *corn*, *fodder*, *wheat*, *oats*, *rye* and *barley*, all the household and kitchen furniture belonging thereto, in any manner, whatever. I also give and bequeath to her in the same manner, my negro man *Charles* about *thirty-five years* of age, and his wife, *Patience*, about *thirty-one years* of age, and their *three* children, to wit: *Robert*, a boy; *Tom*, a boy; and *Viny* a girl; to her during her natural life, and at her death to be equally divided among her children as they become of age, and I appoint my trusty and worthy friend, *Samuel Sanders*, trustee of the property herein given, and bequeathed to my daughter *Emma White*, and all her children, to be divided as heretofore mentioned.

8 ITEM. The residue of my property, both real and personal, wherever and whatever it may be, including that given to my beloved wife,

Sarah, during her natural life, I give and bequeath equally to my sons *Robert* and *William* forever. I hereby constitute and appoint my trusty and esteemed friend, *Daniel C. Simmons*, executor of this my last will, and testament, this 24th January 1861.

ROBERT WILSON, [L.S.]

Signed, Sealed, declared and published by *Robert Wilson*, as his last will and testament, in the presence of us, the subscribers, who subscribed our names herunto in the presence of said testator (at his special instance and request) and of each other, this 4th January, 1861.

{ JOHN P. TRUST,
BENJAMIN WEST,
SAMUEL C. TRENCH,
R. R. KING.

NUNCUPATIVE WILL.

STATE OF GEORGIA, } We, *Samuel Finch*, *Thomas Willis*, *Asa*
Oglethorpe County. } *Poe*, and *David Roe*, were present last
evening, the thirty-first day of Feb. in the year of our Lord, eighteen
hundred and sixty-one, at the residence of *Eli H. Moss*, a bachelor,
before and at the time of his death. About three hours before his
death, in perfect possession of his mental faculties, he called upon us
to remember and take notice of what he was about to say: that it had
been his intention to make his will in writing, and dispose of his prop-
erty some time before, but as it was not convenient for him to do so at
the time, he had neglected since. He now wished us to understand,
that his will and desire was, that, *Mrs. Sarah Moon*, his half sister,
widow of *Samuel Moon*, deceased, should have all his personal estate
of every sort and description; that she was nearly destitute, with four
small children, and had been very kind and attentive to him during
his illness; and that he requested and desired his friend, *Thomas*
Smith, to see that his wishes and desires, in this regard, should be
strictly and fully carried into effect, shortly after which he died, Feb.
13, 1861.

JOHN FINCH,
THOMAS WILLIS,
ASA POE,
DAVID ROE.

AFFIDAVIT OF WITNESSES.

In person, appeared before me, *William Wood*, an acting Justice of the peace, in and for said county, *Jno. Finch*, *Thos. Willis*, *Asa Poe*, and *David Roe*, who being duly sworn say, that this paper contains the last requests and verbal disposition of the personal property of *Eli H. Moss*, late of said county, deceased, and is just and true in all its parts.

Sworn to and subscribed }
before me, this 2d Feb. 1861. }
William Wood, J. P. }

JOHN FINCH,
THOS. WILLIS,
ASA POE,
DAVID ROE.

CONTENTS.

	Page.
Addition.....	12
Subtraction.....	13
Multiplication.....	15
Division.....	19
Tables of Money, Weight, &c.....	23
Reduction.....	26
Fractions.....	32
Caution.....	35
Single Rule of Three.....	39
Double Rule of Three.....	45
Interest.....	49
Discount.....	58
Per centage—Profit and Loss.....	60
Practice.....	67
Deduction.....	70
Insurance.....	72
Commission.....	74
Brokerage.....	75
Barter.....	77
Equation of Payments.....	80
Partnership.....	81
Banking.....	84
Square Root.....	86
Cube Root.....	97
Mensuration.....	101
Quadrilaterals.....	104
Triangles.....	110
Circles.....	111
Spheres.....	116
Miscellaneous Mensuration.....	118
APPENDIX.	
Notes.....	134
Receipts.....	135
Bonds.....	135, 136
Deeds.....	137
Power of Attorney.....	140
Bill of Sale.....	141
Wills.....	141

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